CERAMICS

Ceramics

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Science or Metaphysics?

THIS much maligned subject is treated with disdain largely because of the attitude of so-called scientists. For example, the Department of Scientific and Industrial Research conjures up in the mind of the layman a gathering of very intelligent people. Yet under the title "Human Beings as Meters," D.S.I.R. reports a recent Saturday afternoon conference on "Subjective Judgments."

Apparently many scientists would like panels such as the "taste" panels of the Low Temperature Research Station of D.S.I.R. to be introduced. They will tell you what you want to taste in the way of cheese, beer and pickles!

The objective of this D.S.I.R. conference is crystallised in the sentence "The time is ripe for techniques of subjective studies to be codified." Thus D.S.I.R. is deserting the cause of science and entering the realms of metaphysics.

Standardisation has advantages providing there is only a performance specification laid down which deals with things essentially factual. But standardisation of the senses of touch, taste, smell and so on is the approach of those who would like human beings to be conditioned to their way of thinking.

Science depends upon facts and when scientists begin to draw conclusions from unsubstantiated facts, then they are deserting their cause. One of the steps towards Totalitarianism is to lay down standards of what the people should want! If scientists—and in particular, British scientists—are won over to fight against individuality, it is time that those who wish to preserve the individuality of the individual should refuse to allow their individual income taxes to be so misused.

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FEATURE ARTICLES

MISCELLANEOUS

YESTERDAY AND TODAY

by **ARGUS**

UNFORTUNATELY the politician will use events towards party ends!

On a straightforward issue such as the nationalisation of the cement industry, the protagonists for nationalisation draw attention to the restricted quota scheme in cement in 1938 and use this to point out that private enterprise in cement means restricted output. That was in 1938 when full employment was by no means the position, and this was not due to Governments so much as a world economic shrinkage in demand. Then, protection for the home industry really meant protection of employment for in circumstances of shrinking demand, cut-throat competition in any industry is likely to lead to the aggravation of unemployment. As has been mentioned before, this cut-throat approach led to the unhappy times in North Staffordshire in the between-war period.

But since 1945 the world economic condition has been completely different. Most of the leading countries in the world had been rapidly pouring their resources into the bottomless gulf of war-time production. Thus there was a void for many normal civil needs and the full employment of Britain depended not upon the Government so much as upon this economic void from 1940-45. It is trickery and charlatanism to suggest that the reason is otherwise and can be attributed to one political party or another!

The Cement Industry

Now reverting to cement, the output in 1949 to the home market was nearly 7½ million tons—higher than ever before. Cement factories are working to their full capacity and there is no question that there is any restriction of output, for at the present time the higher the output the greater the profit to the company concerned! So if any politician suggests that there is any organised restriction on output today, he is guilty of misleading the public towards party ends.

Incidentally, prices of cement are up only 58 per cent. on pre-war prices. Pick out any industry, particularly the nationalised ones where price increases are so relatively small!

How to Raise Production

How then can production be increased? The obvious answer to this as in so many other industries, is an extension of factories. We seem to have reached more or less a stage in so many industries such as steel, cement, bricks and so on, where productive output is limited to existing factory space. Modern factories mean modern methods of production with economic usage of labour—therefore their output will be relatively higher, and cheaper.

I think it was an old Chinese proverb—but it doesn't matter—that you can't make bricks without straw—and in spite of aluminium houses, steel houses, and so on, it still seems you can't build houses without a few bricks and a bit of cement! And you can't get any more brisks or cement until factory extensions are completed. And the Government in its wisdom has placed the housing programme of prior importance to factory extensions. And it cannot build houses because it has not any

bricks or cement. So it goes on like a spiral with ever decreasing diameter using up materials which are becoming less and less available and taking no steps to ensure that these supplies will increase.

The Interests of Planned Economy

I am no economist!

Fortunately I escaped attendance at the London School of Economics! But when people try to learn about industry and commerce from text-books written by politicians who are interested primarily in expounding an "ism," this is the sort of crazy planning which is bound to prevail. The Ministry of Health wants more houses and browbeats the Board of Trade to hang on to licences for factory extensions which if they had been granted 2 or 3 years ago would have increased today's output of bricks and cement. The story can be repeated in the steel industry. More steel is required for both home and export, yet in one firm after another one can find steel rolling mills which have been working to capacity for 3 or 4 years and which have extensive schemes for factory extension which are being held up in the interests of planned economy!

Cost of Living

The result is that full employment has been maintained, but its rosy success is drawing to a close. There have been no wage reductions, but the same equivalent, namely, an increase in the cost of living has been felt sharply throughout this country. It is no good saying that this rise is more than or less than any other country in the world. The people affected couldn't care less! They are affected and they don't live in Scandinavia, China or Timbuctoo. They live here!

Because the Government has never encouraged an expansion in private enterprise—the result is that we are now facing the problem of the high prices of our export goods to an ever contracting overseas market. These prices could have been brought down if as a first shot production factories had been expanded. This was not done and as a result we will lose a goodly proportion of the overseas trade which we could maintain if modern techniques and modern factories with reduced handling charges were in operation.

If ever there was a clear indication of unplanned economy it was this. For the first 2 or 3 years of its reign, the glittering prize of the Welfare State was forefront in the minds of the Government. Give away this and that without any attempt to guarantee the increased productivity which was necessary. Heaven alone knows we had little enough resources left in 1945, but never before have so many been given so much from such a small kitty.

Red Herrings

Now comes the pay-off! All sorts of red herrings are drawn across the path—the war in Korea, where a relatively small force is engaged. Uncle Sam has been sending over raw materials to us free of charge—not as a gift or out of philanthropy but because he was trying to bolster up his own economy—and now he has reached the stage where he can't afford to do it any longer.

What steps have we taken in the 5 years since the war to extend our productive output? Practically every basic industry has been working to capacity—those which were nationalised were hamstrung by the politicians who, having once held up their hands in pious horror at the word "profit" are so quick to splash across the front page of the "Daily Herald" whenever they indulge in an enterprise which makes 4½d.! Dividends which were ploughed back into private business were heavily taxed, so that there was little encouragement to spend dividends

on reconstruction. Add to this the restrictions by the Ministry of Town and Country Planning, the Land Development Board, the licences from the Board of Trade and the municipal authorities, the ups and downs of the housing programme—Fred Karno in all his glory could never have portrayed such a crazy approach.

Now that the pay-off is coming, all kinds of excuses are put forward to lead the peoples mind away from the fundamental issue. Because we did not spend materials and money on factory reconstruction, the price of our goods is now too high in the overseas markets; the rising cost of living will be reflected in demands for wage increases which mean even higher prices which of course means less and less sales abroad. If this is planned economy, the *laissez faire* of Victorianism at its worst stands out as something to be admired.

It is no good looking back! It's no good quoting real wages today. The solid fact is that pre-war, the average wage was about £3 10s. 0d. a week and today it is £6. But the purchasing power of the £ bolstered up with child allowances, free health service—and remember the poorer people had a better free health service under the Panel system than they have today—a few million pairs of spectacles—many of which now litter mantlepieces and drawers—distributed at appalling cost and now we stand with an old-fashioned industry producing by expensive methods with a world market fast closing against us.

Holland as Example

Examine the economy of Holland. They had Rotterdam more or less erased, but their first building programme was the reconstruction of industry. In 5 years they expanded and rebuilt their capacity for making building materials to a considerable extent, and now today they are building houses. Because they extended their industry, they are producing more cheaply than we are and because they are producing more cheaply, they are able to sell into markets by undercutting our prices. Their cost of living in relation to wages is much lower than ours. This is not achieved by economics, just by commonsense!

What Now?

Yet the problem is, where do we go from here? Let us hope in the not too distant future we will have a Government which lays down a policy and allows the people who know to meet the targets the Government might suggest.

There is going to be a decreased standard of living and it is useless for politicians of either party to mislead the people.

The only sensible approach is for extensive reconstruction in industry to produce as many goods as possible at the minimum possible price so that we can face world competition. Otherwise we will fall fast into the pit of the recurrent depressions which the economist so frequently talks about. And having done that the Nazi doctrine of directed labour on directed schemes will be the obvious solution for the Government.

This is Totalitarianism!

Only industry and the industrialists can pull us through and instead of discouragement, they need the maximum help possible. Perhaps the Cabinet Minister forgets that he wines, dines, is housed and clothed, is a member of the best Club in the world, and is paid for in his entirety by industrial production—and that goes for all the minions employed in his and his colleagues' Departments!

Figures for houses built in comparison with the Continent are the favourite tunes played on Aneurin Bevan's Celtic pipe.

Will Mr. Wilson give comparative figures for industrial reconstruction?

Chemical Treatment of Clays to Modify Properties

(SPECIALLY CONTRIBUTED)

CLAYS contain, in addition to the ordinary particles visible to the eye or under the microscope, a proportion of very fine particles which can only be rendered visible under special conditions in the ultra-microscope. These are called colloidal particles. The exact size at which a particle takes on colloidal properties is not known, though arbitrary limits have been set by some authorities. Thus for a clay suspended in water we have: visible particles (settle rapidly); particles visible in microscope (settle less rapidly); Colloidal particles (settle slowly). These colloidal particles have properties not shared by the larger visible particles and it is these properties which account for the behaviour of clays and give the possibility of modifying their properties by suitable means.

Properties of Colloids

The more important properties of colloids may be briefly summarised under the following headings.

(*a*) *Surface*.—Colloids being very minute particles have a large surface area. This makes them respond rapidly to chemical treatment, and also promotes absorption of water, giving swelling which aids plasticity. The degree of swelling is also related to the amount of contraction to be expected when a clay is dried. In general more plastic clays contain greater amounts of colloidal material and these are also the clays which show the greatest drying shrinkages and may be difficult to dry.

(*b*) *Motion of Particles*.—The colloidal particles are in a state of rapid and constant motion. This is called the Brownian movement, after its discoverer. The motion is considered to be induced by bombardment of the colloidal particles by the other molecules present in the system, e.g. water molecules, which are themselves in a constant state of motion in all directions. This Brownian movement helps to keep the colloid particles in suspension and prevent sedimentation.

(*c*) *Electric charges*.—The colloid particles, by absorbing electrically charged ions from the liquid or solution with which they are in contact, become themselves electrically charged. Thus clay particles assume a negative charge in contact with water. The repulsion between charged clay particles helps to prevent them joining together to form larger visible particles, thus stabilising the system. If this charge on the particles can be neutralised, by for example, adding a chemical furnishing charged ions of opposite sign to the clay suspension, then the particles lose their special properties and tend to form aggregates which settle more or less rapidly. The colloid is said to "coagulate" or "flocculate." At the same time the power of swelling is to some extent lost, with attendant effects on plasticity.

The charged nature of the particles can be demonstrated by passing an electric current through a suspension of clay in water. The clay collects around the positively charged electrode. This fact was formerly used in some countries for purifying china clay. The addition of chemicals, e.g. sulphate of aluminium is still

used to precipitate some grades of china clay used in paper making.

(d) Protection of Colloids.—The addition of another substance in small amounts to a colloid suspension may render it less sensitive to the action of those agents which tend to coagulate it, e.g. acids, salts, and heat.

These substances are colloidal in nature and include gums, wares, etc, and they are called "protective colloids." It is assumed that they form a coating around the colloidal particle.

Modification of Clay Properties

Seeing that the properties of clay colloids are well known, it is not surprising that from time to time investigations have been undertaken to explore the possibility of modifying the properties of clays by suitable chemical treatment, with the aim of improving them. Generally speaking these have followed two lines:—

(a) treatment of the clay to improve its drying characteristics and to cut drying losses.

(b) treatment to improve plasticity, resulting in lower handling losses and sometimes in lower power costs in the making machinery.

These treatments involve doing opposite things to the clay, and illustrate that an improvement in one direction may be attended by a drawback in another. Thus it may be possible to improve the workability of a clay and at the same time make it more difficult to dry.

These factors must be carefully weighed before deciding whether chemical treatment of a clay is worthwhile.

Improved Drying Characteristics

Where a clay is very plastic it contains a relatively large amount of very fine colloidal clay particles. In such clays the capillary pore structure in the mass along which water can escape to the surface, is not so well developed as in coarse grained, less plastic clays. Consequently water may tend to evaporate from the surface of the clay faster than it can be replaced by water drawn from the interior.

The result is that the surface shrinks faster than the inside, strains are set up and in due course drying cracks appear. Such a clay is difficult to dry without loss unless special methods are adopted. These will vary with the circumstances. Where only a few large pieces of ware are involved it may suffice to cover with damp bags and allow to dry very slowly. Where the output is larger, humidity dryers may be installed. These represent a large capital expenditure and it may be worth experimenting to see whether chemical treatment of the clay would be a cheaper alternative.

One obvious method of improving drying characteristics is to add sand or grog to the clay to improve the pore structure, or as we say "to open up" the clay. Many a sticky clay has been made workable in this way. Similarly it may help in burning out carbonaceous matter in the clay by making it easier for air to penetrate the heated mass.

Another method is to treat the plastic clay with a chemical which will coagulate some of the colloidal material and thus, by increasing the size of the particles, improve the pore structure and allow water to move easily to the clay surface.

Acid Addition Improves Brick Clay Drying

Remembering that the clay colloid particles are negatively charged it should be possible to neutralise this charge and thus coagulate the clay, by the addition of substances which produce positively charged ions in solution such as acids and salts. Those ions which possess the greatest number of positive charges are more effective than those with only single charges when used in similar amounts.

H. H. Macey (*Trans. Brit. Ceram. Soc.* **34**.396.1934-5) reviews previous work on the subject and describes the effect of using hydrochloric acid as a coagulent on a number of brick clays. In all, twenty-four were used of which fifteen were fire clays and nine brick clays, of the latter there were samples from most parts of England. Hydrochloric acid was chosen, as it appeared from the literature to be efficient and it also avoided the complication of introducing metallic compounds, which might have had an effect on the firing characteristic of the clays.

He found that in some cases the acid prevented cracking to a very large extent, but in others the effect was slight. A sedimentation test was found to be an easy and rapid method of determining whether the clay was likely to respond to treatment. The clay samples were suspended in water, varing amounts of acid added to each, and the time required for the clay to settle noted. Maximum coagulation of the clay was assumed when settling occurred in about 15 minutes or less. This also gave an indication of the amount of acid required.

This was not large in those cases where it proved beneficial, and was rather less than the maximum required for complete coagulation of the clay. It was not greater than 0·25 per cent. and represented a pre-war cost of approx 3s. per ton of dry clay. The beneficial effects of acid additions were not nullified when the clay was fired.

Other investigators, notably in America, have studied the effect of developing plasticity in lean clays and shales by treatment with small amounts of alkali such as sodium carbonate. The effect of this is to deflocculate the clay and produce stable colloidal systems in which the particles can absorb water and swell, the clay becoming more plastic.

As with acids not all clays respond to the treatment, but in the majority of cases an improvement can be made by adjusting the *pH* (i.e. the degree of acidity or alkalinity) of the natural clay. The pioneers of this method of treating clays were Barker and Truog. They found that

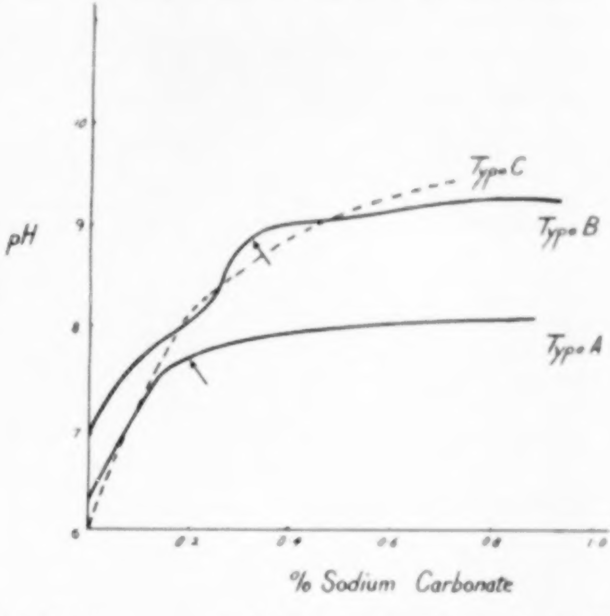

Fig. 1. Effect of adding sodium carbonate on the pH value of natural clay

(*After Barker and Truog*)

most natural brick clays can absorb small amounts of sodium carbonate, and if a curve of the variation of *p*H in the clay against alkali addition is plotted, three types of curves are obtained of which Fig. 1 is typical.

In type A the *p*H value rises rapidly when the alkali is added and then there is no further change. Such clays respond most readily to the treatment with alkali and the amount to be added is given in the curve. It is the amount required to give the break in the *p*H curve (indicated by an arrow in Fig 1).

With type B the curve shows two inflexion points. The first is considered to be due probably to aluminium salts in the clay, and these react initially with the alkali. The correct alkali addition is that required to produce the second inflexion in the curve (again indicated by an arrow in Fig. 1). Type B is considered to be a special case of type A.

Type C clays show no pronounced inflexions in the alkali-addition *p*H curve. These clays are usually acid and require rather larger amounts of alkali to render them alkaline. Frequently they do not respond well to adjustments of *p*H by alkali treatment.

Titrating Clay with Alkali

The method recommended by Barker and Truog (*J. Amer. Ceram. Soc.* **24**.318.1941) is to weigh out a series of samples of the damp clay as used on the plant, so as to give a dry weight of 20 grams. These are transferred to beakers and a known volume of 0·1 per cent. sodium carbonate solution is added. Distilled water is then poured in to bring the volume of each test sample up to 50 cc. of liquid.

The first sample is treated with water only, in all, about eleven samples normally suffice for plotting a titration curve; the second sample receives 0·1 per cent. sodium carbonate and the eleventh 1 per cent.

Having made up the samples, they are well stirred and the *p*H determined with a *p*H meter. Alternatively the clay can be titrated by taking 10 grams of the powdered dry material in 100 cc. distilled water and adding a 0·5 per cent. solution of sodium carbonate in increments of 1 cc., determining the *p*H after every addition. Each cc. represents the addition of 0·05 per cent. of sodium carbonate. The curve is then plotted by marking off the *p*H value on the vertical axis and the per cent. of sodium carbonate on the horizontal. The optimum amount of alkali to be added is then the amount required to cause a flattening of the *p*H curve (0·2 per cent. with Type A clay in Fig. 1 for example).

Results of *p*H Adjustment

When the titration has been properly carried out and the proper amount of alkali added it will be found that with non-acid clays of the A and B type the addition of alkali brings the *p*H within the range 7·3-10·5. With acid clays of type C the best results are obtained when the *p*H range is adjusted to 6·0-8·5. Further addition of alkali produces no further improvement in the clay properties and may even do harm. The amounts required are very small, usually of the order of 0·2-0·3 per cent.

With properly controlled treatment of the clay the following improvements are claimed:

(1) it will become more plastic;
(2) it will have a more closely grained structure;
(3) it will require less tempering water;
(4) it will extrude more readily.

In addition:

(a) lamination may be minimised;
(b) green strength will increase, though the closer texture of the ware may lengthen the drying time and may possibly make drying more difficult;
(c) fired strength will increase;
(d) water absorption will be lower;

(e) usually the colour will be brighter.

Experience in Works Trials

Barker and Truog (ibid **22**.310. 1939) describe the results of *p*H adjustment on a number of clays in the U.S.A.

Tests of Shale Clays

The dry shale was treated with barium carbonate to remove soluble salts, and ground and screened. The alkali was added with the mixing water to raise the *p*H to 8·0. In this condition the clay extruded more readily from the pug, the clay column was stronger and the cut edges of the brick smoother.

Crushing strength and moisture absorption of the fired brick were improved (average of five tests).

	Moisture absorption per cent. 24 *hr. cold soak*	*5 hr. boil*	*C/B ratio*	*Crushing strength lb./sq. in.*	*Per cent. increase in strength*
Treated clay (*p*H 8)	2·93	5·38	0·55	10,660	55
Untreated clay	5·4	8·36	0·65	6,874	

On another plant using the stiff plastic method a decrease of 20 per cent. in power consumption was noted when the shale was treated with alkali. In other respects, however, this clay showed no particular advantages after treatment. The *p*H curve of this clay was of the B type, and the authors comment that it would probably be necessary to inactivate soluble salts before the maximum benefit of the *p*H adjustment could be obtained. As the ware produced was already of satisfactory quality it was felt that it might not be an economic proposition to proceed further with chemical treatment.

Test With Drain Tiles

This plant used a calcareous surface clay and ware was formed by extrusion. There was some difficulty with formation of longitudinal cracks in the fired ware, these also appeared in a sectioned green tile. The clay gave a type A curve with sodium carbonate, and after *p*H adjustment to 9·2 the clay extruded much more rapidly, was much softer, and the cracks disappeared.

Tests with a Soft Plastic Clay

With this type of clay, found in the Hudson River valley a type A curve was obtained, but full alkali treatment rendered it too plastic, the bricks losing their shape on the pallets. The clay was certainly more workable and tougher after treatment, but only partial alkali treatment could be given to avoid losing shape. When this was done the fired bricks were sounder, porosity was about halved and crushing strength increased by 18·5 per cent. The authors conclude that these advantages warrant the *p*H adjustment, if the problem of economically drying the treated clay can be worked out.

Finally tests are described with wire cut bricks in the Chicago district, where calcareous clays are used. After prolonged laboratory trials a works trial was put in hand using the sodium carbonate treatment. The clay was softened and extruded more easily. The bricks were stronger and there was less crumbling at the edges. A higher temperature was required to dry the more dense brick. This was successfully accomplished. A better colour was obtained on firing, and there were less broken in the kiln. The fired bricks were stronger and less porous. The savings in breakages nearly paid for the alkali treatment.

Cause of Improvement by Alkali Treatment

Barker and Truog (ibid **21**.324. 1938) consider that the colloidal

portion of clays contains minute crystalline particles, whose behaviour profoundly affects that of the clays. These are of the type

$$XO\ 4Al_2O_3\ 16SiO_2\ xH_2O$$

where X is a divalent metal. X is replaceable by other metals or hydrogen and the process of doing this is called "base exchange."

Treating the clay with sodium compounds results in the formation of $Na_2O\ 4Al_2O_3\ 16SiO_2\ x\ H_2O$ while in lime-bearing clays base exchange has produced $CaO\ 4Al_2O_3\ 16SiO_2\ x\ H_2O$ and in acid clays it may be $H_2O\ 4Al_2O_3\ 16SiO_2\ x\ H_2O$. The nature of the base exchange compound affects the properties of the clay.

When saturated with Calcium and hydrogen the exchange compounds cause the clay to flocculate easily giving a granular structure, which may be low in plasticity. On the other hand saturating the base exchange compound with sodium ions

$$CaO\ 4Al_2O_3\ 16SiO_2\ x\ H_2O + Na_2CO_3 \rightleftharpoons Na_2O\ 4Al_2O_3\ 16SiO_2\ x\ H_2O + CaCO_3.$$

$$H_2O\ 4Al_2O_3\ 16SiO_2\ x\ H_2O + Na_2CO_3 \rightleftharpoons Na_2O\ 4Al_2O_3\ 16SiO_2\ x\ H_2O + H_2O + CO_2$$

causes the clay to deflocculate.

This is possibly due to the fact that the exchange compounds are plate-like structures separated by the metallic exchangeable cations. When the exchangeable cation is sodium, which has a great affinity for water, the particles swell and eventually disperse, and cause deflocculation. The aim of treatment with alkali is to replace sufficient of the exchangeable cations with sodium to bring about the increase in plasticity.

Other Methods of Treating Clay

H. G. Shurecht, J. F. McMahon and C. M. Lampman (*ibid* **25**.346. 1942) studied the effects of combining various treatments on a New York Chemung shale. These proved more efficient than individual treatments, and the best results were obtained when the clay was pugged with steam and hot water, with 0·2 per cent. added soda ash. In this way the water of plasticity was lowered 26 per cent., drying shrinkage 58 per cent., and absorption 46·5 per cent. At the same time the strength in the green state was increased 123 per cent. and in the fired state 144 per cent.

Sufficient has been stated to show that chemical treatment of clays may profoundly modify their characteristics. One word of caution is necessary. Before deciding on treatment careful laboratory trials are necessary to find whether the clay will respond to treatment at all, and if so, to determine the best quality of alkali to be added to give the properties to be desired. In addition, of course, the economics of the process will require careful study.

SILICONE LUBRICANT FOR CONVEYOR IN 700 F. FURNACE

As a result of satisfactory operating service with a lubricant of silicone fluid, a drawing furnace will be constructed for operation at temperatures up to 700° F. in which the conveyor will move through the furnace instead of outside it.

Laboratory tests and limited experience in industrial plants has indicated that the lubricant, Dow-Corning 710G silicone fluid, is satisfactory for conveyors under light loads at temperatures ranging from zero to 700° F. Bearings are first lubricated with 710G, and relubricated as required with Dow-Corning 710, which is the same as 710G but without graphite.

In service, trolleys lubricated with 710G have shown no tendency to harden or "lacquer up." The lubricant remains liquid and free from stickiness so that the graphite contained in solution functions satisfactorily under a broad range

of operating conditions.

The usual operating practice has been to inject about ¼ fl. oz. teaspoon of 710G into each trolley. Bearings with retainers are used, so that the fluid will not contaminate the Bonderite or cleaning fluid.

Operating experience to date indicates that this type of conveyor lubrication is satisfactory up to 700° F. under loads as high as 400 lb. Previous experience with mineral oils under these conditions had resulted in excessive carbonising and sludge formation, and the use of additional graphite failed to satisfy the operating requirements.

Iron Age, 166 16.83.

HONEYWELL-BROWN LTD.

THE above company announces the recent opening of a sales and service office associated with their Blantyre works, Lanarkshire, Scotland.

The intention of this office is to provide Scottish industry with readily available assistance on the technical application and maintenance of the Brown ElectroniK Potentiometer Pyrometers and Protectoglos being produced at these works.

Mr. P. R. Prior, who has had several years experience with the company both on the sales and service side, will be in charge of the office.

Requests for information should be addressed for his attention at Honeywell-Brown Ltd., Block 4, Scottish Industrial Estates, Blantyre, Lanarkshire.

CERAMICS v PLASTICS

THE American *Chemical Engineering News* writes: "The ceramics and the plastics people have been tussling for some time. Contention concerns tableware. Plastics manufacturers are making a big pitch to sell plastic ware in homes, school cafeterias, hospitals, and hotels. But the ceramics people say the same autoclaving should be applied to all dinnerware and they wonder whether the plastic products can be "properly sterilised" in public eating places. American Cyanamid's Melmac ware, condensation product of aldehydes and amines, meanwhile is being advertised heavily by numerous suppliers and moulding companies. Melmac advertising warns autoclaving is impossible but allows steam sterilisation up to 200° F. Moulders who have obtained clearance from hospitals and chain food organisations on melamine state that steam sterilisation or "final rinse" at 200° F. meets requirements."

FUSION CAST REFRACTORIES

by

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Part II

The "ZAC" Block

DEVELOPMENTS foreseen by the manufacturers of Corhart refractories are indicated in their patents dating as far back as 1925, in which the inclusion of up to 10 per cent. of zirconia is mentioned, though with the silica remaining in the region of 20 per cent. This modification was found, however, to have no advantages either in manufacture or in use, and was abandoned. In later developments just before the 1939-45 war, a "ZED" block was produced, containing between 15 per cent. and 20 per cent. of zirconia and with the silica reduced to about 10 per cent. This was a definite improvement on the earlier product, but it was very soon superseded by the "ZAC" block, now coming increasingly into use, having the composition:—

Al_2O_3 50 per cent.; ZrO_2 33-34 per cent.; SiO_2 11-13 per cent.; TiO_2 $<$ 1 per cent.; Fe_2O_3 $<$ 1 per cent. and Na_2O 1·3-1·5 per cent.

The process of manufacture is essentially similar to that used for making the original Corhart, so I need not deal with the production processes in any way.

Apart from the major changes in composition there are important differences between the new "ZAC" block and the original Corhart product in respect of the amounts of "fluxes" present as impurities. This is achieved by the use of raw materials of much greater purity than natural bauxite, namely, artificial alumina, zircon, and zircite or baddeleyite. In this way the composition of the fused-cast block can be controlled within comparatively close limits and, in particular, the amounts of Fe_2O_3 and TiO_2 can be kept below 1 per cent. as compared with 1-3 per cent. and 3·5-4·5 per cent. respectively in the original Corhart blocks.

Addition of Soda Ash

A simple mixture of alumina, zircon and zircite would be difficult to fuse, and the electrical conductivity of the molten mass would be low, since the amount of alkali present would be limited almost entirely to the alkali in the artificial alumina. There would thus be difficulties in maintaining the current after the layer of coke had been burned away and, moreover, the changes in crystal form would take place only very slowly in the absence of any substantial proportion of alkali to serve as a "mineralising" agent. By the addition of some 2 per cent. of soda ash (Na_2CO_3) to the mixture a sufficient electrical conductivity can be ensured when the mass becomes fused; re-crystallisation is also facilitated or accelerated. The amount of sodium oxide added to achieve these results is kept down to the minimum since, as I stated very early in this lecture, the properties of any glassy matrix remaining in a refractory block after firing are largely determined by the amounts of the "fluxes" present, and particu-

larly on the amounts of alkali present. Owing to the presence of this added soda and of the small amounts of alkali, iron oxide, and titania in the original raw materials, and owing also to the high temperatures reached during fusion, the "ZAC" blocks contain approximately 25 per cent. of glassy matrix, a typical analysis of which is:

SiO_2 44 per cent.; ZrO_2 28 per cent.; Al_2O_3 17·2 per cent.; Fe_2O_3 2·8 per cent.; TiO_2 2·8 per cent.; Na_2O 5·8 per cent.

This is determined on the solution obtained by treating finely powdered "ZAC" (100 mesh) with strong hydrofluoric acid at 0° C. for a period of about 40 hours, by which time all solvent action has apparently ceased. The crystalline constituents remaining after this treatment represent approximately 75 per cent. of the original material, in the proportions Corundum (Al_2O_3) 45 per cent., Baddeleyite (ZrO_2) 27 per cent., Mullite ($3Al_2O_3$, $2SiO_2$) 3 per cent.

A similar examination of Corhart standard shows that the solvent action of hydrofluoric acid ceases after about 12 hours, indicating that the matrix is more siliceous than the matrix in "ZAC" blocks; the proportion of glassy matrix removed from Corhart standard is approximately 30 per cent. of the original material.

Incidentally, the proportion of Na_2O in the glassy matrix of "ZAC" blocks raises the thermal expansion coefficient of this glass to approximately the same value as the thermal expansion coefficients of the constituent crystals, this largely eliminates the internal strains which would otherwise be set up during the heating of the blocks.

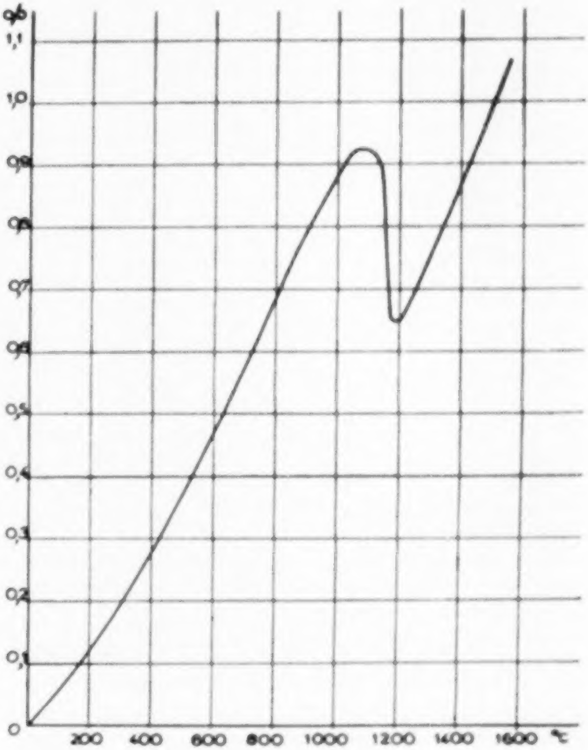


Fig. 1. Expansion curve of Corhart "ZAC" block showing anomalous expansion due to Zirconia content

The properties of these two varieties of fusion-cast blocks could be discussed and compared with those of ordinary fire clay blocks at considerable length, but time will not permit of this. Some brief comparisons may be made, however, more particularly relating to their behaviour in use and to the treatment necessary in bringing them up to working temperature when built into a furnace.

The density is much higher than that of ordinary fire clay blocks, the apparent density being 3·2 to 3·3 for standard Corhart, and 3·7 for "ZAC," as compared with 1·9-2·0 for an average fire clay block.

Low Porosity

The porosity is very low, about 3 per cent., all the pores being closed, whereas porosities of the order of 18-23 per cent. or more are usual in fire clay blocks. This, combined with the internal strains left after cooling, makes care necessary in bringing the blocks up to working temperature, though the low coefficient of thermal expansion (0°-800° C.) 6×10^{-7} per degree Centigrade, and the comparatively high thermal conductivity (0·012 C.G.S.-Centigrade units) greatly reduce the risk of "spalling" as the temperature is raised. The expansion coefficient of an average fire clay block over the same range, 0° C.-800° C. is of the order of 6×10^{-6} per degree Centigrade, and the thermal conductivity is about 0·004 C.G.S.-Centigrade units.

Owing to the high thermal conductivity of the Corhart standard and Corhart "ZAC" blocks, the blocks should be air-cooled on the outside during use.

In the "ZAC" blocks the anomalous expansion of zirconia in the region 1,000°-1,200° C. is shown in a modified form and must be taken into account when a furnace constructed of or containing "ZAC" blocks is being brought up to working temperature, or is being cooled down for repairs (Fig. 1).

Wear Resistance

The superior resistance to wear of "ZAC" blocks as compared with standard blocks can be clearly shown, but it would be difficult to give any precise figures for the wear of Corhart standard and Corhart "ZAC" blocks as compared with fire clay blocks, largely because there have been marked improvements in fire clay blocks during the past 10 to 15 years. In the middle 1930's it would have been fair to say, however, that in soda-glass tanks a Corhart (standard) block 8 in. thick would last between two and three times as long as a fire clay block of good average quality 12 in. thick.

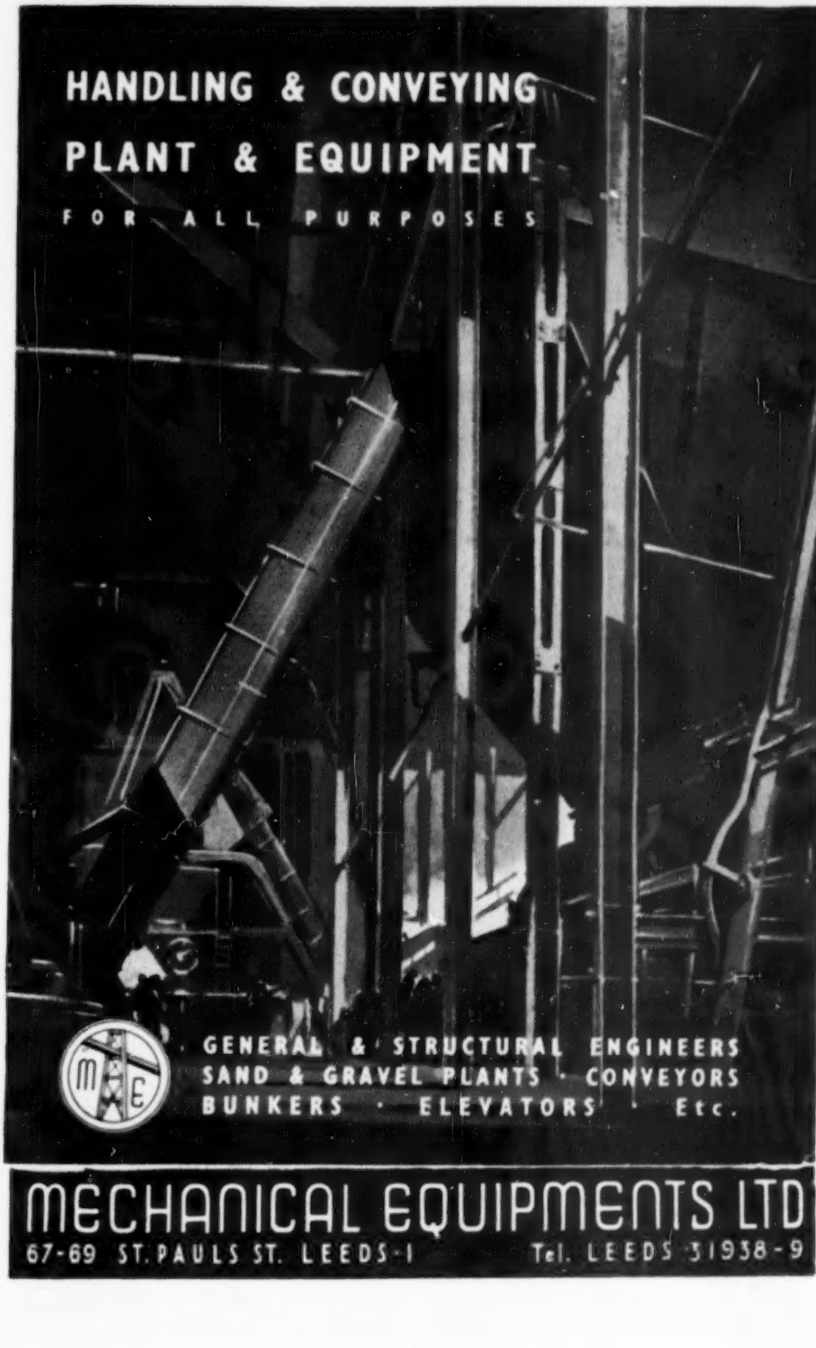
A point to be noted in relation to the use of Corhart standard blocks in glass melting is that glasses containing boric oxide in large amounts have a comparatively high corrosive action on these blocks and their use in tanks for the melting of borosilicate glasses of the "PYREX" type is not recommended.

So far I have limited myself entirely to blocks of the Corhart standard and Corhart "ZAC" types. This is not unreasonable, since these were the first fusion-cast materials specially developed for use as refractories. There have, however, been other important developments along parallel lines, though their applications were limited for a time by the original master-patents, which were very widely drawn.

I have already mentioned the attempts made on the Continent to produce fusion-cast refractories from fire clays. These were of no practical interest because the raw material was not of the right type.

Monofrax Refractories

Refractory materials of high alumina content have been developed, however, by the Carborundum Company under the general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name of Monofrax refractories. These are of three types, designated by the letters H, MH, and K. Types H and MH contain 92-95 per cent Al_2O_3 with some Na_2O, SiO_2 and CaO and with Fe_2O_3 and TiO_2 present as impurities not exceeding 0·3 per cent. in total, of which 0·12-0·18 per cent. is Fe_2O_3.

Melting is carried out electrically, and the blocks are cast under a substantial hydrostatic pressure (equivalent to some 40 to 45 in. of water) to minimise the risk of pockets or voids within the blocks. Descriptions of the processes have not been published in detail, but the products bear out the manufacturer's claims that the blocks are free from warpage, are well filled out to the corners, and that internal voids are reduced to a minimum.

The H blocks consist almost entirely (over 99 per cent.) of beta-alumina crystals with a negligible amount (less than 0·5 per cent.) of glassy matrix. The porosity is fairly high for a fusion-cast material, being of the order of 10 per cent. or slightly higher; this, combined with its moderately high thermal conductivity (approximately 0·008 C.G.S.) gives the H block a resistance to spalling which is higher than that of fusion-cast materials in general.

Addition of Corundum and Beta-Alumina

Type MH is of substantially the same composition as Type H, but the crystalline constituents include both corundum and beta-alumina, and the proportion of glassy matrix is higher, approaching 1·8 per cent. The crystals are much smaller than in the H type, and the porosity is much lower. Although no information is published concerning the differences in methods of manufacture, it would appear from these differences in structure that the Monofrax MH is chilled more rapidly than Monofrax H after casting.

The differences in structure are such as to render the MH product more resistant than the H type to corrosion by molten glass, whereas Type H would be better than Type MH for superstructure and furnace crowns, on account of its higher porosity.

Introduction of Ferric and Chromic Oxide

The Type K represents a rather startling departure from the point of view of the glass manufacturer, since ferric oxide and chromic oxide are intentionally introduced in amounts of approximately 5 per cent. Fe_2O_3 and 8 per cent. Cr_2O_3, the Al_2O_3 content being 83 per cent. to 85 per cent. The texture is very close, consisting mainly of corundum, containing some Fe_2O_3 and Cr_2O_3 replacing Al_2O_3 in the crystal structure, with about 13 per cent. of crystals of the spinel type containing chromium and iron with a high proportion of alumina. The amount of glassy matrix is negligible.

The intensely strong colouring effects produced by even small proportions of chromic oxide in glasses are well known, and the introduction of chromite into a refractory for use in glass making was a step not to be taken without grave consideration by the manufacturers of the refractory. The intensity of the colour imparted to a glass melted in a tank constructed of Monfrax K would, of course, depend on the amount of refractory material dissolved per ton of glass drawn, and, provided that the refractory was sufficiently resistant, might be so slight as to be of no importance. Actually, in a full-scale tank, melting ordinary sheet glass, with K blocks 18 in. deep fitted as a top course, where the corrosion would be greatest, the chromic oxide introduced into the glass was found to be only 0·0008 per cent., the corresponding increase in the amount of iron oxide being of the order of 0·0006 per cent.

It is to be noted, however, that an amount of chromic oxide of the

order of 0·001 per cent. is capable of giving a just discernible green colour in a thickness of ½ in. of glass. Monofrax K is thus not entirely suitable for the construction of tanks in which exceptionally white glasses are to be melted, particularly if the tank is working under comparatively light loads; under such conditions the amount of refractory dissolved in relation to the weight of glass drawn would be appreciably greater than in sheet glass manufacture. In such cases the MH type would be more suitable despite the somewhat lower resistance to corrosion.

Glass Melting and Metallurgy Requirements

In this lecture I have dealt with fusion-cast refractories from the point of view of their use for glass melting. This is partly because I know most about them from that aspect, and partly because they are much more likely to be used in glass melting than for most of the metallurgical processes in use at the present time.

Refractories for most metallurgical purposes are required to withstand cyclic changes of temperature of considerable magnitude, and thermal shock resistance or spalling resistance is one of the main requirements. Resistance to corrosion is a secondary matter, apart from the economic point of view, since any material derived from the refractories is taken up into the slag and does not contaminate the finished metal.

In glass melting, on the other hand, high spalling resistance is of secondary importance, since, when once a tank is started up it is kept running continuously, sometimes for periods up to 3 years, during which time the temperature variations are only slight. Resistance to corrosion is, however, a first consideration, partly because it ensures long intervals between shut-downs for repairs, but mainly because all the products of corrosion are taken up by the glass.

Corrosion Resistance

Some solution of the refractories is unavoidable, but it is important that the material dissolved should not cause degradation of colour. The dissolved material also causes variations of glass composition; these may not be of great importance provided that the material from the refractories is completely dispersed in the glass, but if dispersion is not complete the products of corrosion give rise to cords, knots and stones which render the glass unsaleable.

Fusion-cast refractories, with their low porosity and comparatively low spalling resistance are thus not well suited to processes involving large cyclic changes of temperature. These properties are not disadvantageous, however, in continuous processes where temperature changes are slight, as in glass melting and in the small continuous kilns now coming into use for the melting of highly corrosive vitreous enamel frits. Their high resistance to corrosion fits them particularly well for these latter uses and, of course, would be of advantage if continuous metallurgical processes could be developed. I do not know what chance there is of this, but if such processes are contemplated, the use of fusion-cast refractories would certainly be well worthy of consideration.

£50,000 JOB FOR WM. JOHNSON & SONS (Leeds) LTD.

THIS firm have just received an order for a brickmaking plant for the Commonwealth of Australia, amounting to about £50,000, with an output of 10,000 bricks per hour. This order, which is for the establishing of brickworks at Canberra, has been obtained against competition from not only British manufacturers, but also the U.S.A.

SPACE HEATING WITH CLEAN GAS

Possibilities for Ceramic Firing

TOWNS gas has proved itself to be a most economical method of space heating. However, since towns gas contains invariably a proportion of sulphur bearing compounds, this has meant that gas appliances burning towns gas have not been recommended in enclosed spaces. As would be expected, this has placed a limitation upon the use of towns gas as a heating medium and expensive arrangements have been made in the past whereby the products of combustion are either conveyed to a flue or else the burning of the gas itself has been used as a heating medium for circulating water, generating steam, or even heating air. The loss in efficiency arising from this conversion is obviously great.

Purifying Medium

Some time ago, this problem was investigated in the Bristol area, and arising out of this was the formation of a company to develop the system employing a purifying medium known as "Carbocell," manufactured by the National Smelting Corporation. This latter company conducted a prolonged series of tests in the development of this material, including a space heating installation where several hundred thousand c. ft. of gas were burned and the atmosphere produced thoroughly examined.

To state the case from the beginning, the main sulphur-bearing compounds from towns gas, carbon bisulphide and sulphur trioxide, although present in purified towns gas to but a small extent, if gas containing these compounds is burned, they may tend to produce a deleterious effect upon the health as well as an adverse effect upon the comfort of those who breathe the fumes so produced.

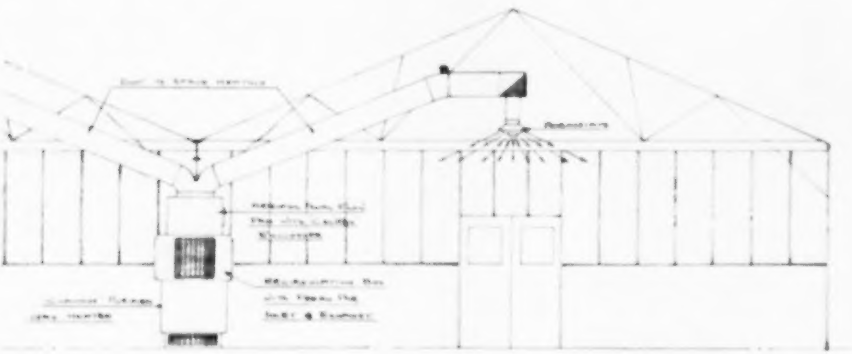


Fig. 1. Diagrammatic layout showing heat source to one section and lead to another

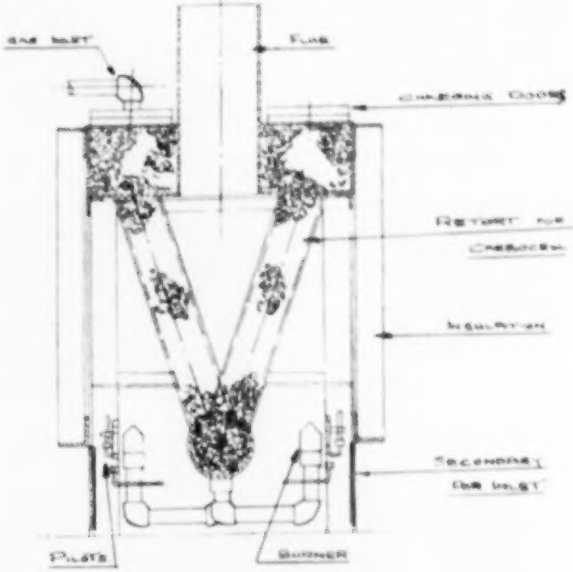


Fig. 2. Cross section through heater and purification unit

Fig. 3. General view inside the factory showing heater unit in the background

Now there has been developed a compound which when heated will absorb the sulphur bearing compounds in the towns gas and reduce it from 20 grains per 100 c. ft to 1 grain. By the use of this process the products of combustion arising from burning towns gas anywhere in the British Isles are quite innocuous in so far as the operative in a factory or the child in school is concerned.

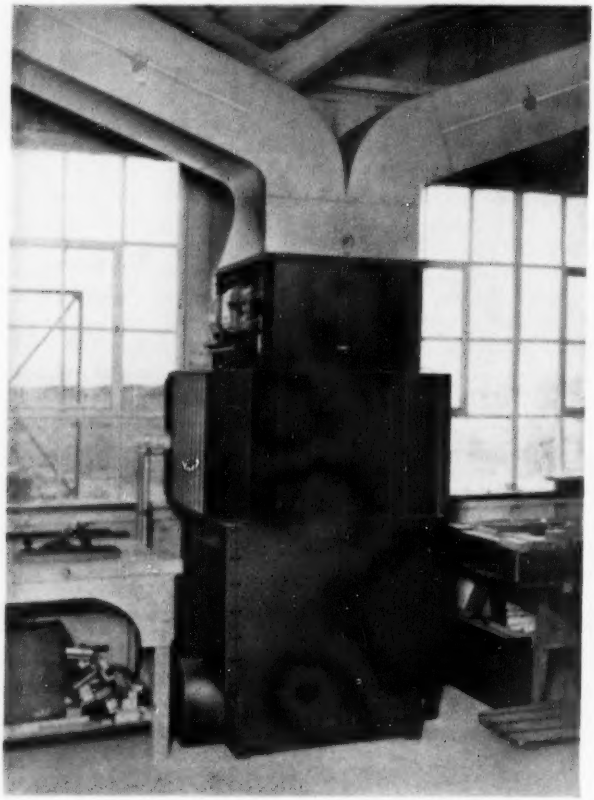


Fig. 4. Close-up of the unit, which consumes approximately 600 c. ft. of gas per hour

An Actual Installation

We had an opportunity quite recently of visiting one of these installations at Joinery and Insulation Co. Ltd., Thames Road, Barking, installed by the Chandos Engineering Co. Ltd., of 17 High Street, Egham, Surrey, the company which is manufacturing the "Chandos" heater which is here employed.

The factory is assembling wooden insulation cabinets. The floor space is approximately 6,500 sq. ft. with the offices at one end of the building. The unit assembly containing the gas burners is at the other end from the office, and consumes an average of approximately 600 c. ft. of gas per hour. The installation is designed to raise the temperature in the building from 30° to 60° F.

Fig. 1, shows a diagrammatic layout of the building in which the heat sources in the factory and offices are shown. Fig. 2 gives a cross-section through the heater and purification unit. It should be noted that towns gas is controlled for pressure drop by a governor, after which it passes into a retort

system centrally disposed in the plant. In this is packed the purifying material known as "Carbocell." Thence the purified gas passes to the burner system.

On lighting up, the operative applies a light to the pilot jet, and the mains supply of gas to the burners will not pass even though the cocks are opened until this pilot is lighted, which opens a relay valve through the medium of a "Thermoperl" safety device. The burners heat up the "Carbocell" material in the retort. An axial flow fan drives the heated combustion products which are mixed with recirculated air and any ancillary air coming into the system from outside the building through ducting where it is vented into the building, at a controlled temperature.

Cost

The capital cost of this installation works out approximately at £680, including gas controls and safety devices. It must be borne in mind that the installation of this system eliminates the necessity for a boiler house, fuel store and chimney stack, the saving on which would in most instances go a long way to help cover the cost of the installation. With gas at 10d. per therm, the overall average cost of running this installation per hour amounts to 2s. 6d.

Although the products of combustion contain a small amount of water vapour, this has proved to be quite innocuous in so far as the operatives are concerned. To avoid the problems of condensation, the heater is turned off about 10 minutes before the fan so that the building is left with a neutral atmosphere when the factory closes.

Points to be noted include:

1. Within 10 minutes of lighting up, an adequate supply of hot air is being delivered.
2. Almost the maximum conversion of gas to heat possible takes place within the building, and there are no flue losses whatsoever.
3. The variation in sulphur content from one area to another is taken care of.
4. The claim is made that for workshops in which there are many openings and doors and windows which are alternately closed and opened, the hot air from the overhead distributors acts as a blanket against the cold air coming in from outside. There is no doubt that a flueless heater such as this offers many advantages as an industrial heating medium.

Developments are taking place in the ceramics industry with the object of firing ware. Here sulphur containing compounds from the combustion of towns gas can be extremely deleterious, and the direct produced pure atmosphere offers many advantages in economy and processing.

MODERN DEVELOPMENTS IN METAL FINISHING

Arrow Press Ltd., 29 Grove Road, Leighton Buzzard, Beds.
5/- Post Paid

THIS is an edited version of eight lectures given recently at the Northampton Polytechnic, London, under the auspices of the Head of the Applied Chemistry Department, Dr. J. E. Garside.

The contents include: Developments in Electrodeposition Processes and in Plant for Electrodeposition, by E. A. Ollard, F.R.I.C., F.I.M., of the British Non-Ferrous Metals Research Association; Phosphate Treatments for Iron and Steel, by H. A. Holden, M.Sc., A.R.C.S., D.I.C., A.I.M., of the Pyrene Co. Ltd.; The Protection and Decoration of Aluminium, by V. F. Henley, B.Sc., F.R.I.C., of W. Canning and Co. Ltd.; and Methods for the Protection of Magnesium Alloys, by W. F. Higgin, Ph.D., of Magnesium Elektron Ltd.

Three lectures dealing with the history and general principals, the composition and application methods and their industrial applications of vitreous enamel are included by W. E. Benton, M.Sc., of S. Flavel and Co. Ltd., S. Hallsworth of Metal Porcelains Ltd., and H. Laithwaite M.Sc.Tech., A.R.I.C., of Radiation Ltd.

DRUM-COAT

THIS is a new non-mechanical method of printing letters, numerals, trade-marks, etc., on to all types of cylindrical containers. The loss of time and messy wastage of materials, in stencilling such markings is completely eliminated.

The application of the Drum-Coat process is shown in the illustration. A film of rub-proof and weather-resistant ink is rolled-up on a slab, transferred by hand rolling on to the composition type of formes, over which the drum is rolled without manual effort.

Further information can be obtained from Parsons, Fletcher and Co. Ltd., 72-78 Fleet Street, London, E.C.4.

Illustration showing the application of the Drum-Coat process

British Made Joints in 132 kV Power Export Scheme

FOR the transmission of cheap water power electricity from Norway via Sweden to Denmark, a new transmission line is now under construction. This is additional to the existing export of Swedish power to Denmark by means of 50 kV. cables crossing the Oresund from Helsingborg to Helsingor.

The new line will follow the same route, but the cables will be 132 kV. 3-phase 185 mm^2 flat type (Fig. 1) weighing approximately 40 kilograms per metre for the submarine cable and approximately 27·7 kilograms for the corresponding land cable. The manufacturers are the Northern Cable and Wire Works, Copenhagen.

The submarine cable length is 5·5 kilometres and the land lengths amount to 5 kilometres. The permanent load of each cable is about 60 mva. and there will be two cables in parallel plus one spare cable. In the first stage, however, only one cable will be laid.

As there are cliffs 40 metres high on both shores, a 3-phase 132 kV. Pirelli-General oil-filled stop joint is being installed half way up each rise.

These joints are similar to the usual type of oil-filled cable stop joints, with the exception that the joint ends are shaped to conform to the three core flat type oil-filled cable. The joints are built up with paper tape insulation applied over a connected pair of porcelains, and consist of three such pairs of porcelains into which the suitably prepared cables are inserted, electrical continuity being preserved by flexible connections enclosed within stress controlling screens. Figure 2 shows a stage in construction with one pair of porcelains completely taped. One half of the screen has been removed at the

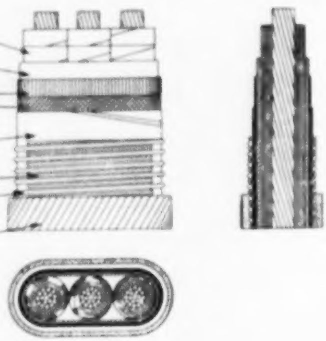


Fig. 1. Diagram showing details of new cables which are of the 132 kV. 3-phase 185 mm^2 flat type

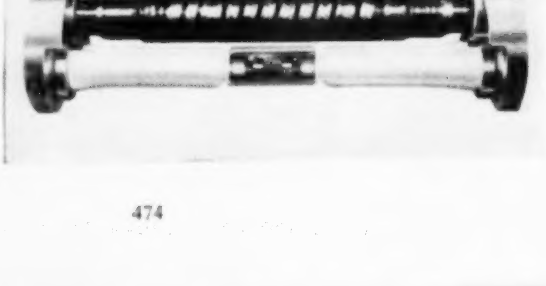


Fig. 2. A stage in the construction, with one pair of porcelains completely taped. Also shown are the flexible connections

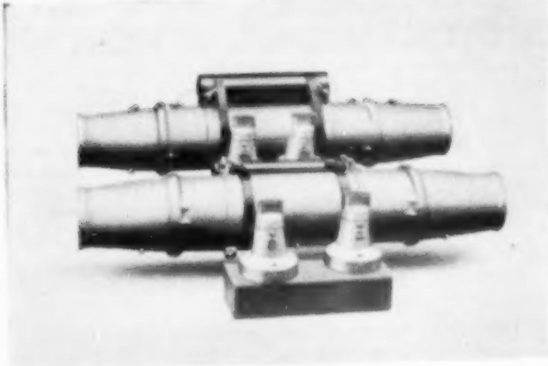


Fig. 3. The two joints, complete with pressure tanks and joint ends

front, to show the flexible connections.

Each joint is permanently sealed, dried under high vacuum and impregnated with oil before leaving the Pirelli-General works. A small pressure tank is connected to allow for expansion and contraction of the oil with temperature variations, thus ensuring that the joint remains perfectly impregnated throughout transit and storage. This tank is removed after installation of the joint. The two joints, complete with pressure tanks and joint ends are shown in Fig. 3.

NEWS FROM SCOTTISH BRICKWORKS

SCOTTISH brickworks are now operating at full pressure and are still unable to meet the demand for bricks. Many local authorities have reported that deliveries are unequal to their building capacity and are only keeping their men employed for part of the week.

This change in the brick supply position follows the long and difficult period when bricks were freely available but remained unsold. Shortages of other materials—and notably a shortage of cement—limited the amount of construction work which could be tackled. Brickmakers were then faced with the necessity to stock and, when stocking space was filled, to lay off labour. In that period brickwork managements made representations to the Secretary of State for Scotland protesting against the lack of use of the facilities which they had been encouraged to provide.

With a definite improvement in the cement position, the demand for bricks has gone ahead. Stocks have been eaten up and many users are now relying on current deliveries to keep their jobs moving.

A leading West of Scotland brickworks confirms the difficulty pointing out that the situation is one which brickworks sought to avert and could have averted had normal full scale production been encouraged. Despite the lack of demand most brickworks went on producing and credit is due to them for that contribution.

Now, full shift working is being adopted to meet the impact of revived demand and the industry is certain that it can catch up if given a period of time to do so. Building normally tends to fall away during the winter months and if this should be the case this year the brickworks will have a chance to again build up stock.

Glasgow offices are not too certain of this trend. If the coming months remain open, building might well continue over the winter on a fairly heavy scale and production could quite easily be eaten up from day to day.

In that case there might be little chance to build up reserves and the shortage might well continue.

Modernisation and Mechanisation

One pleasant feature of the situation is that most Scots companies have been tackling modernisation and mechanisation of their works on a steady basis over the past few years. Their major complaint was indeed that they were encouraged to do so and then found themselves denied the outlet which that modernisation was intended to meet. The industry is thus in a position to produce on a modern

basis, at the present time and will thus meet the new emergency with up-to-date plant and premises.

There has been an upward trend of prices coincidental with this scarcity. In some cases local authorities have set a ceiling price for their buying. One authority, Dundee, fixed this in the region of 140s. per 1,000 and soon found that supplies could not be obtained at that figure. After a period of scarcity the ceiling was raised to 148s. per 1,000 at which price a rather better supply could be assured. The current advance in prices has been largely dictated by production cost advances and does not stem from any effort to benefit by the scarcity.

Current prospect is that prices and demand will remain firm and that production will be cleared out as long as constructional work goes on—and provided that no major political or financial crisis intervenes to limit the activity.

RUSTON-BUCYRUS LTD.

THIS firm of excavator specialists took the opportunity of announcing at the Public Works and Municipal Services Exhibition, an addition to their range of Universal Excavators, the 22-RB of ¾ c. yd. capacity. This is a new machine of the same general design as the popular 10-RB ⅜ and 19-RB ⅝ yard.

The new 22-RB excavator of ¾ c. yd. capacity, shown by Ruston-Bucyrus Ltd., at the recent Public Works and Municipal Services Exhibition

The 22-RB however embodies certain improvements and refinements based on operating field analysis including:

(a) New diesel engine—Ruston "4 YEN" with main clutch enclosed in bell housing. Engine is rated 66 h.p. at 1,200 r.p.m.
(b) New design caterpillars with round type tumblers for smoother travelling. Particularly low bearing pressure of 6.80 lb. per sq. in.
(c) 3 pairs of equalising hook rollers.
(d) Automatic lubrication and complete gear enclosure.
(e) Improved gear design.
(f) Boom hoist unit of entirely new design and of the controlled lowering type. Enables the boom angle to be varied whilst the machine is travelling or swinging or when the load is being raised or lowered. Particularly effective when machine is used as a crane.

The 22-RB is available with any or all of the usual equipments, shovel, dragline, dragshovel, skimmer, grabbing or lifting crane.

22-RW Well Drill

A well drill with machinery in motion was also shown. This is a churn drill with pneumatic tyred mounting and powered by a "Ruston" diesel engine of 22 h.p. This machine is capable of drilling water wells from 6 in. to 16 in. dia. to depths varying from 100 ft. to 1,000 ft.

High Temperature Measurement in Ceramic Manufacture

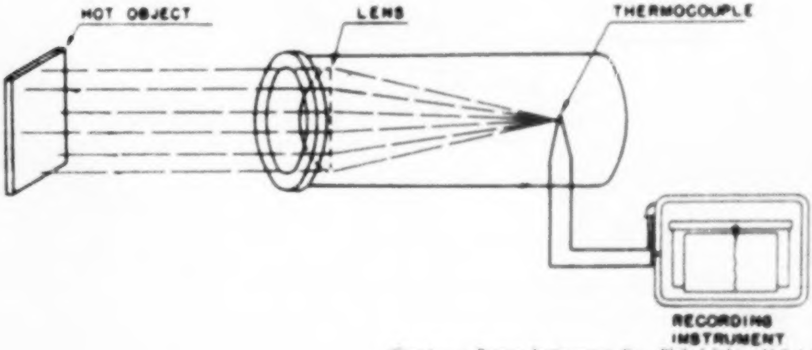
by

LEO WALTER
A.M.I.Mech.E., M.Inst.F.

THE importance of instruments in the manufacture of ceramics needs no emphasis. Whether it is formation of goods, drying, or kiln firing for finishing, exact temperature measurement and automatic control is essential. The demand for more accurate instruments has grown in recent years due to more scientific methods being applied to ceramics manufacture, but at the same time makers of instruments have been successful in improving the design of pyrometers, mainly as regards accuracy and responsivity. The science of thermo-electric pyrometry, embracing now a temperature range up to 3,000° F., has produced quick-acting thermocouples, working in connection with a potentiometer circuit in balance. The reduction of instrument time lags and improved magnification of minute measuring impulses produced electronic amplifiers which overcome the limitations of galvanometer instruments.

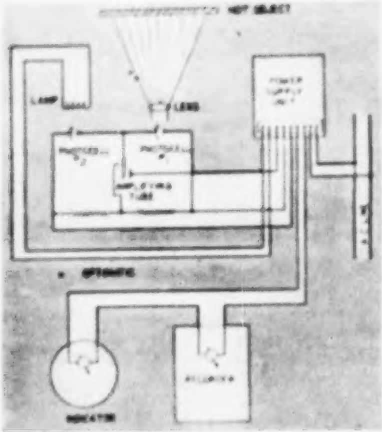
Principles of Operation

Modern electronic amplifiers magnify an electric impulse developed from a thermocouple from, say, 0·000003 v. to 7 v. which is about two and one-half million times. The use of electronic tubes will, therefore, be found in many modern pyrometer types, operating with practically no measuring instrument time lag. Radiation pyrometers utilise the heat rays emanating from a hot body, the temperature of which should be ascertained. By focussing these rays upon a small thermocouple, or on a thermopile (group of thermocouples), a minute electromotoric force is produced.



(Courtesy: Brown Instrument Co., Philadelphia, U.S.A.)

Fig. 1. Measuring principle of radiation pyrometer



(Courtesy: Mineapolis-Honeywell Brown Co., Philadelphia, U.S.A.)

Fig. 2. Working principle of optical pyrometer using a photocell

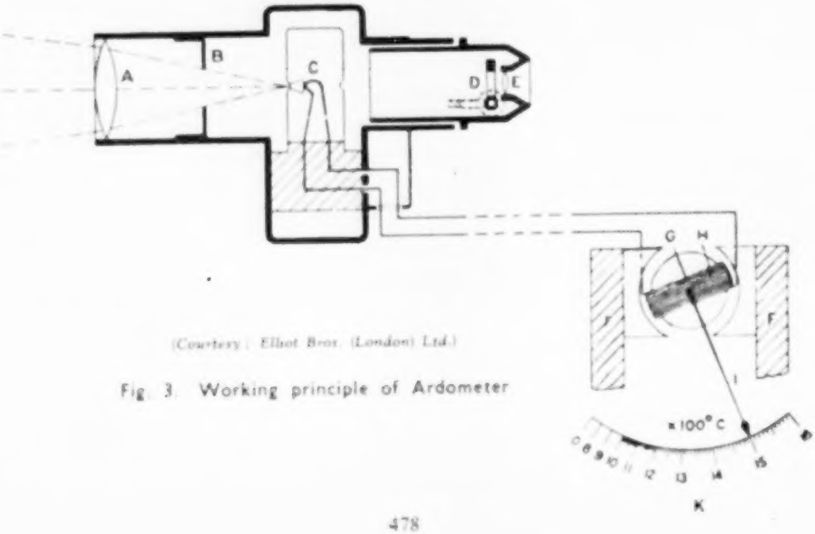
Fig. 1 illustrates schematically this measuring principle, which gives very good results where it is applicable.

Optical pyrometers utilise the colour of the heated body as the basis for temperature measurement. By comparing it with a standard colour, comparison and measurement can be achieved. Fig. 2 illustrates diagrammatically a modern system, using a photocell, the electrical resistance of which varies with the intensity of light to which the tube is exposed.

The scheme shown employs two photocells, connected into a bridge circuit. Instead of a galvanometer, an amplifying electronic tube is employed for balancing the bridge. With changing intensity of the light, the electric circuit in the plate circuit of the amplifying tube will change. This alters the lamp current and also deflects the galvanometer calibrated in degrees of temperature, thus producing measurement.

Comparing Filament Type

The comparing filament type of optical pyrometers is well-known to the ceramic engineer, and is based on comparison of light from the hot body with a standard electrical bulb. By connecting the latter to a Wheatstone Bridge, and using the resistance of the lamp filament as one arm the temperature indicator pointer is deflected. With an optical pyrometer focussed on the source of heat, direct temperature reading is readily obtained. The presence of flames

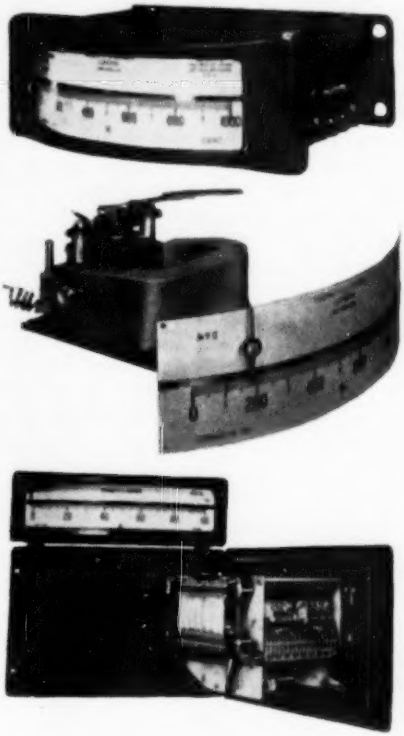


(Courtesy: Elliot Bros. (London) Ltd.)

Fig. 3. Working principle of Ardometer

or smoke, however, may introduce errors for optical instrument types, and thermocouples are preferable.

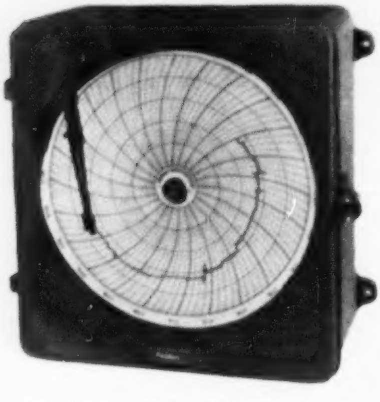
The well-known Ardometer (see Fig. 3) is a type of total radiation pyrometer where four thermocouples are connected in series, each attached to a small blackened plati-



(Courtesy: Negretti and Zambra Ltd.)

Fig. 4a (top). Single point electrical thermometer of the thermocouple type. b. (centre). Movement of electrical thermometers. c. (bottom) 10 in. multi-point electrical indicator resistance type

num plate. The radiation from the heated body is focussed on this plate. The electromotive force generated is then measured by a multivoltmeter instrument calibrated in degrees of temperature. After focussing the



(Courtesy: Fielden (Electronics) Ltd.)

Fig. 5. A recording servograph

instrument a continuous temperature indication or recording is obtainable.

Instrument Types

The following are the main instrument types available from various makers of measuring and controlling instruments, as applicable to the manufacture of ceramics. *Edgewise indicators*, as shown in Fig. 4 illustrate (a) the outside view of a single point thermometer of the thermocouple type, and (b) the movement of electrical edgewise indicators for temperature measurement, while (c) shows a modern development, namely a multipoint indicating instrument. This type of instrument can be applied for ceramic kilns, furnaces in brickworks, etc., in conjunction with special thermocouple types, having a flange for fitting the thermocouple head to brickwork. The mechanism is housed in a black finished diecast case, and the front cover hinges outwards for making wiring connections and for balancing the electric circuit. A hermetically sealed selector switch of the mercury-in-glass type enables indication of a multitude of temperatures by simply turning the selector knob. The number or title which is connected to the measuring point is illuminated, so that the operator knows at a glance which reading is taken.

(Courtesy: Elliot Bros. (London) Ltd.)

Fig. 6. Instrument panel for Ascot kiln

A strip chart instrument of the modern Potentiometer Recorder type may be used for furnaces, ceramic kilns and for any measurement of temperatures, preferably in conjunction with thermocouples. The characteristics of all progressing recording instruments are clearly visible chart records, easy accessibility of the interior mechanism, and interchangeability of parts. Modern strip chart instruments also allow easy change of speed of chart movement, if desired, and by cutting off the chart end from the lower chart roll, daily records can be kept in strip form, or strip lengths for each batch can be cut out and filed. The modern tendency is more to have rather permanent records on file, in the form of charts, in order to investigate process performance, than to rely on indication alone.

As an example of *Circular chart instruments* Fig. 5 shows a modern electrical graph recorder, which can be connected to thermocouples and other primary measuring elements. A servo-motorised mehanism is controlled by a moving coil, but the pointer of the standard movement is replaced in this instance by a small light vane. A second vane is moved by the servo-motor, and an electronic capacity relay controls the latter. The makers claim that it takes the pen only 25-30 sec. to traverse the circular chart. As the system is servo operated and the pen mechanism is motor-driven, switching operations can be affected at any desired maximum—or minimum temperature.

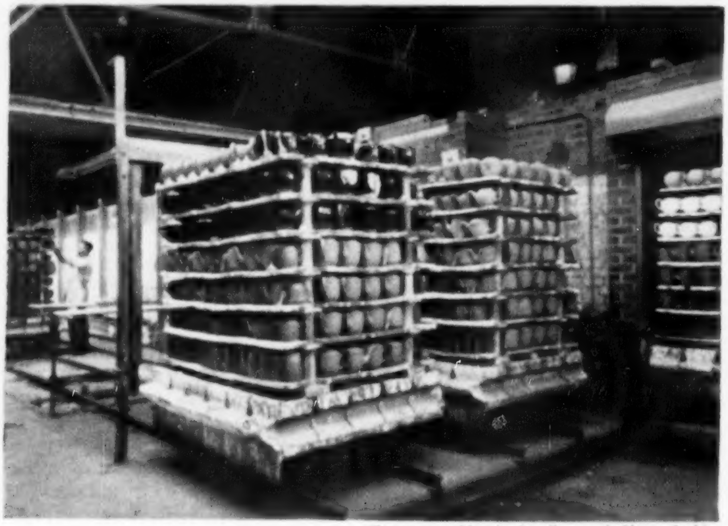
Instrument Panels

The progressive development of plant equipment for manufacture of ceramic goods necessitates more elaborate instrumentation, and the use of instrument panels has become more pronounced in modern plants. Panels can consist of one or two instruments only, or they can be larger and contain several indicators

and recorders. For example a 12-way switchboard and edgewise multi-point temperature indicator, mounted near a furnace, and connected to an optical pyrometer, enables the foreman or plant operator to select the point of temperature measurement and see at a glance the result on the scale. Another typical instrument panel for kilns incorporates two Elliot multi-way multi-colour recorders mounted on the panel, having strip charts, and an indicator temperature controller which regulates automatically kiln temperature (Fig. 6). The entrance to the kiln is illustrated in Fig. 7 and shows an "International" gas kiln, firing glost and biscuit. Three thermocouples are used in the pre-heating zone, actuating one of the multi-way recorders shown in Fig. 8. Three thermocouples are located in firing zones, and three in the cooling zone of the kiln, and are recorded on the second recorder on the instrument panel. The firing is automatically controlled by regulating the gas supply to the firing zones.

A new instrument which has great possibilities for practical applications, where electronic measurement should be applied is the electronic automatic potentiometer which was shown for the first time at the Physical Society's Exhibition, 1950 and is available as a single-point or a six-point recorder with strip chart, or with circular chart if desired. The instrument which can be used as high-temperature recorder in conjunction with thermocouples is characterised by extreme simplicity in its design. By using a magnetic inverter for magnifying the measuring impulses derived from the thermocouple the instrument design eliminates delicate moving parts, as used in older galvanometer instruments. The only moving parts of the mechanism consisting of the sensitive detector circuit are those associated with the slide wire contact. A pen speed of 3½ sec. for traversing the full scale span is attained, thus making speedy reaction to temperature changes possible.

An instrument panel showing three multi-point recorders of modern design is illustrated in Fig. 8. Similar panels are available for measurement of high or low tem-



(Courtesy: Alcock, Lindley and Bloore Ltd.)

Fig. 7. "International" gas-fired kiln for glost and biscuit

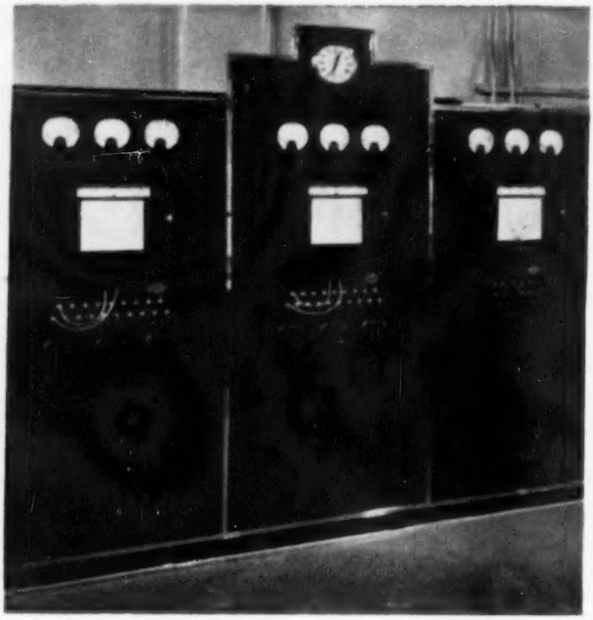


Fig. 8. Instrument panel with multelec strip chart recorders

(Courtesy: George Kent Ltd., London)

peratures in the ceramic industry for firing or drying temperatures, etc.

Conclusion

The foregoing examples of designs and applications of measuring instruments for high temperatures show how modern instrumentation has kept in line with the design of improved heat treatment plant. No doubt, new plant will usually be well equipped with modern instruments, but although it seems obvious that correct temperature measurement improves uniformity and quality of the goods, and in addition provides the means for fuel economy, much remains to be desired for increased and improved instrumentation of existing plant. Close co-operation between the plant engineer and the instrument expert would no doubt soon improve matters, and it is recommended that the ceramic engineer should look deeper into the matter of improved instrumentation of existing plant. To make the best use of, sometimes not so up-to-date heat flow equipment, can be often achieved by a comparatively small financial outlay for modern measuring instruments.

The next step for modern processing is elimination of the "human element," personified in the plant operator. A following article will deal with modern methods of automatic high temperature *control* in ceramic manufacture.

(*To be continued.*)

Laboratory Porcelain.—The Worcester Royal Porcelain Co. Ltd., 30 Curzon Street, London, W.1, issue a leaflet on "Laboratory Equipment," such as, filter crucible, micro-filter crucibles, Hirsch funnels and micro-filter sticks with porous porcelain filter discs.

Belt Preservation.—Under the above title we have received a most useful booklet from Robert Sutcliffe Ltd., Universal Works, Horbury, Wakefield, dealing with practical steps which can be taken to preserve the life of factory belting which, it is stressed, is an expensive import item.

MATHEMATICS AND THE POTTER

by DR. H. W. WEBB

DR. H. W. WEBB, O.B.E., principal of the North Staffordshire Technical College, lectured on "Mathematics and the Potter," at a recent meeting of the North Staffordshire and District branch of the Mathematical Association at the Hanley Town Hall.

He said he supposed there were few, if any, industries, no matter whether they were craft industries or not, in which the workers did not use some elementary form of arithmetic. Such arithmetical processes were common in our everyday existence and although they were so familiar we did not always recognise them as such.

Common-place Feature of Research

It was almost a common-place feature of research to arrive at a series of experimental results on an empirical basis, and then to seek a mathematical expression which co-ordinated them, gave them a scientific meaning and enabled us to predict the lines of further research needed to bring out fundamental data.

This universal necessity for an understanding of mathematics over a wide grade of employment, is so obvious to those whose work lies mainly in applied science in industry that it is always a matter of wonder that so many young people entering industry are so badly equipped in this particular phase of knowledge. They seem to regard mathematics as a painful memory, something so abstruse and useless as to be forgotten at the first opportunity.

I know it is fashionable to blame teachers for almost every defect in youth today, but I feel the examination tradition is probably the greatest sinner in this respect. I do not see how science or mathematics can be taught as a vital living subject, full of interest in relation to social and industrial life, by teachers who have to bother about the percentage of passes in some public examinations.

Brongniart's Formula

Dealing with the background of elementary mathematics for the potter Dr. Webb said that probably the earliest arithmetical language the young technician came across concerned the volumes of mixed vessels, pints, gallons and pecks. The young potter's arithmetical start also included the method of calculating the dry content of a pint of slip of a given weight, knowing the specific gravity of the suspended material. This, known as Brongniart's formula was accepted by the industry as accurate, and indeed it was mathematically accurate but not scientifically accurate because of a queer thing some solids did when suspended in water. He had never told the industry this because he thought they had troubles enough and the error was not usually very large.

Shrinkages

Dr. Webb also referred to the mathematics of shrinkages to which the young potter, with the idea of modelling shapes in clay, would have to pay attention. In the simplest case he might only have to deal with linear contractions. If a plate had to be 9 in. in its finished (glazed) state he would need to calculate its size in the condition of dry clay, and

also when it was as plastic clay on the mould, because the necessary mould dimensions must be calculated. The pottery industry tried to make this a little more difficult, of course, by making plates roughly 2 in. larger than they were supposed to be. A 7 in. trade plate for example would measure 9 in. This was a relic of the days of severe competition. When they came to holloware it was not quite so simple since here they must sometimes design to a prescribed cubic capacity.

Surface Area

There are many more complex problems involving shrinkage, since the percentage contraction of clay was not always the same in all directions. Another interesting mathematical exercise for the young technical potter was the measurement of the surface of powdered materials as a means of measuring the fineness of grinding. Pottery making, at least the firing part of it, was essentially a reaction between small particles of different substances, and the rate of reaction was dependent on the surface area of the particles. The effect of fineness of particle was important in almost every section of pottery making, whether in bodies, glazes or colours.

Afterwards Dr. Webb went on from the simple routine mathematics with which most young technical potters are familiar to deal with a few unsolved or partly-solved problems of interest to applied mathematics.

Mr. I. R. Vessels, of Alsager presided and thanks were expressed to Dr. Webb by Professor I. Sneddon of the North Staffordshire University College

(With acknowledgement to the *Evening Sentinel*.)

E. Boydell and Co. Ltd., of Manchester 16, have added to their range of mechanical handling plant an entirely new hydraulic loader, known as the L.H.1. The L.H.1, which is pictured above can be used in the most confined working conditions, while restricted height and length make driver visibility excellent in any position. Motive power is provided with a hard duty petrol engine developing 35 b.h.p. (diesel power is optional). Speeds up to 12 miles per hour are obtainable, while loading in excess of 20 tons per hour, and unloading in excess of 25 tons per hour is possible

BRITISH POTTERY MANAGERS' & OFFICIALS' ASSOCIATION

TABLEWARE PRODUCTION

by

NORMAN WILSON

MR. NORMAN WILSON, director, Josiah Wedgwood and Sons Ltd., addressed the British Pottery Managers' and Officials' Association, on 6th November, at the North Staffordshire Technical College as follows:

Introduction

I thought the title of this talk would enable me to cover a fairly wide field without going too deeply into any one subject. This was partly laziness on my part and partly appreciation that most of you here cover the same wide area in your daily duties.

I have had in mind throughout that we are still enjoying a boom—at any rate in the export markets, that many countries are now planning their own production of tableware and that normal competitive times may not be far away.

In the event of another world war, I imagine restricted mass production of utility ware would be the order of the day, but tableware production would be a secondary worry anyway.

The type of product obviously determines the layout of the factory whether the factory is a new one on paper or an old one in the course of modernisation. The broad choice is between mass production, bulk production, or variety production, with interesting possibilities in the way of compromises.

The need for all three types is fairly obvious although real mass-production of tableware in this country has yet to be tried.

(i) Mass-Production

Mass-production has been tried and proved successful in America where market conditions warrant it. For most low-priced and much medium-priced pottery, mass-production, with as much mechanisation as possible, is the logical method of production, providing as it does long runs of a strictly limited number of articles and patterns. The product is largely designed to suit the factory and the pocket of the prospective user. The ideal for such production is a three or four shift factory highly mechanised, using its capital continuously instead of the usual 47 hours out of 168.

(ii) Variety Production

Many firms in this district, particularly the fine china and earthenware group, owe their success to high quality variety production. The variety is often formidable and constitutes a nuisance to the production people, but it is this variety that appeals to the overseas buyer.

If this variety is allied to superlative quality the combination is irresistible to the potential user who buys this type of pottery specifically to escape from the other sort. This is particularly true in the North American markets.

Making fine pottery is very similar to making fine furniture and painting; it is a job for craftsmen to be sold to the individualist who appreciates fine workman-

ship and, perhaps, something different to his neighbour.

Upon the appreciation of this simple fact lies the future success of many firms in this district. For such firms to imitate the Americans would, in my opinion, be the height of folly. It would amount to the loss of an almost world monopoly in ceramic craftsmanship.

The goose that now lays golden eggs would soon become a hen laying very low-priced hen eggs, very much like American hen eggs.

(iii) Bulk Production

Whilst some people insist on original paintings and prints, others who cannot afford them like good copies. This, in the Potteries, provides an excellent opportunity for the half-way house. Reasonably long production runs, reasonable variety, and mechanisation of some sections, retaining craftsmen for the essential craft processes, seems to be the sensible line of approach being made by many manufacturers at the present time.

Even in the manufacture of, say, fine china, there is no merit in hand methods and manual labour for their own sake. Mechanical aids to eliminate drudgery in all sections are most desirable. A difficulty with mechanisation of high grade pottery is knowing where to draw the line. If the product is flexed to suit the machine and the machine is, by degrees, allowed to govern the type of variety of product, then high-grade variety production ceases and bulk or mass production takes its place.

With cheaper ware, the position is quite different. Apart from pride of ownership and the danger of suppressing a budding Wedgwood, I can see no merit in fifty firms producing fifty lots of very similar low-priced mediocre ware. There would be much to be gained by producing the whole output in one modern factory by mechanical means. Half the people now employed could be released for other useful work.

In welcoming mechanisation and modernisation, let us be quite certain that the new process or machine maintains or enhances the fine quality of our products. In an age that has produced the television set, some well-proved old equipment is in danger of acquiring the stigma of original sin. As a gardener, I submit the wheelbarrow is a very effective piece of equipment, especially if fitted with a rubber tyre—do not scrap it or chromium plate it.

Choice of Body

Although most people have had this question settled for them, it will serve my purpose to assume we have to make a choice.

The broad categories to choose from are:—

(i) Bone China.
(ii) Earthenware.
(iii) American Vitreous China.
(iv) Continental Hard Porcelain.

For traditional reasons, this country has specialised in the first two types, with excursions into the hard porcelain field. I do not know of any firm in this country which is yet making the American type.

A desirable specification for all types should be:—

A body which can be potted fairly easily, which will fire straight in the biscuit oven and economically in both biscuit and glost.

In the biscuit state the water absorption should be as low as price conditions permit, the ideal being a completely vitreous body.

The glazed product should be craze-proof and be able to withstand scratching and the wear and tear of washing machines, etc.

For extreme durability and hard wear, under-glaze decorations would be employed—alternatively on-glaze colours which will stand up to the standard acid and alkali tests. The ware should not chip easily, or silvermark.

GRAFTON
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This famous kiln frees the potter from all firing anxiety. No previous experience is necessary to operate it, the temperature being controlled by a single hand-wheel throughout its range up to the maximum of 1300°C (2372°F). *Send today for full specification.*

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The various articles with decoration should match each other fairly exactly and be capable of easy repetition with normal factory controls.

Needless to say, the articles should serve the purpose for which they were designed, and should be pleasant to look at and to handle.

Characteristics

American type vitreous ware has much to commend it in that it combines good North Staffs potting and firing practice with Continental type materials, viz., a hard biscuit fire followed by a lower glost fire using felspar and quartz. The resulting body is completely vitreous, partially translucent and hard wearing.

Continental hard porcelain is ideally suited to chemical porcelain, but is more costly to produce than, say earthenware. For tableware, its chief merit is a very hard glaze which stands up well to hard wear without scratching. It is not very attractive to look at and is rather brittle. Although some catering firms insist on it for hotel use.

Bone China is probably one of the best ceramic products for tableware. It is much stronger from a chipping point of view than either English earthenware or Continental porcelain. It is a beautiful material to look at and feel, and is accepted the world over as the best material for traditional teaware, but it is rather costly to produce as dinnerware.

It is not easy to make because of its low plasticity and it has a narrow safety margin in biscuit firing—two properties which have provided this district with a bone china monopoly.

Earthenware covers a multitude of wares from vitreous hotel ware to porous earthenware. Provided the porosity is not too high, say, less than 10 per cent., earthenware has much to commend it. It is plastic, easily potted, and fairly straightforward to produce. Properly designed and potted, the thrown and turned version can beat all comers for detailed precision. It is so simple to produce in its primitive forms that it is almost a dangerous material in the wrong hands, that is, from a crazing and absorption point of view.

Factory Layout

The main function of any factory is to produce the designed output as economically and easily as possible. The product should move progressively from one process to another with the minimum of effort so that carrying and breakages are cut down as far as possible.

A one-floor factory has many advantages and, if segregation of noisy work from quiet is obtained, and dusty processes from clean, this is probably the ideal. The entirely open factory as used by many engineering concerns and some American potters is not ideal for North Staffs craftsmen. Different craftsmen have varying problems and conditions of work and these can only be met by sensible segregation.

Where ground space is restricted and in other special cases, say for mills, sliphouses and inter-connecting decorating processes, definite advantages in handling costs can be obtained by multi-storey buildings and conveyors.

Less Expensive Materials

In view of the developments which take place fairly rapidly nowadays, and because future sales possibilities are difficult to assess, I think new factories should be built of less expensive material than is now usual. Light steel structures, covered with insulated board on the meccano principle, seem to have much to commend them. Similarly, internal expansion should be provided for in all sections. If machines and people are too tight on the ground, a minor alteration becomes a costly nuisance. Other points worth careful attention are good lighting, without glare or shadow; smooth floors, designed for easy

cleaning; and well-planned traffic routes.

Noise is a modern curse and can be a seriously disturbing factor to people doing close work, and incidentally the wrong sort of "Music While You Work" can have the same effect!

Equipment—(i) General

Up to fairly recently, tableware equipment followed a rather conservative policy, not unlike the British Railways, in that it went in for plenty of cast iron and heavy timber, which was intended to last a long time.

Some progress was made between the wars, but the biggest impetus came as a result of war-time contacts with other engineering trades. This has been followed by interchange of ideas with the American potters.

There has been much progress, perhaps the most important items being:—

Smaller tunnel kilns using towns gas or electricity.
De-aired pugs.
Semi-automatic making.
Small mangle dryer for clayware and dipped ware.
Semi-automatic turning of cups.
Wedgwood autoclave for transferring prints.
Leicester shoe machine for transferring prints.
Wedgwood/Sulzer fully-automatic flat machine.
Schweitzer aerographing machine.
De-airing of plaster.
Solid rubber grinding cylinders.
Standard conveyors as in general use in other industries.
Tungsten carbide, heat-resisting steel and Kanthal.

In addition, many of the old machines have been tidied up and given a new look without altering the basic design.

Whilst most of the changes constitute improvements, I think many of you here will endorse a word of

warning. A new piece of equipment, to be an improvement, must maintain or enhance the quality of the final product. Undue haste in certain processes, particularly in potting, drying and biscuit firing, may prove uneconomic in the long run.

The old North Staffs potter was a poor engineer, but he inherited a long background of experience which made good pots. This local tradition, combined with the technical training of the North Staffs Technical College, produced a mixture which will take a lot of beating. Development on the engineering side is overdue, but let us be cautious until the new potting engineers have bought their experience. In research, it is necessary to have guinea pigs—let us guard against becoming the corpse that produces the bigger and better guinea pigs.

(ii) Tunnel Kilns

The design and disposition of tunnel kilns to a large extent governs the general factory design. The subject is well known to all of you so I do not propose to go very deeply into the matter.

I think very large tunnel kilns for tableware have had their day. They are too inflexible, and temperature differences throughout the truck setting are too great.

Two tunnels for any given output are generally better than one. Kilns 2 ft. across and 2 ft. to 2 ft. 6 in. high give better heat distribution and shorter possible firing cycles than bigger kilns. In fact, smaller kilns have most of the advantages except in the matter of capital cost.

Batteries of very small cross-section kilns are attractive but should be used with discretion. Quick firing cycles are possible and desirable for small articles if bodies and glazes are designed to suit, but these miniature kilns are not suited to bigger articles or the safe production of old type North Staffs bodies. An earthenware body that is durable and craze-proof when fired for 70 hours in a round oven is not durable when popped in and out of a kiln, say, designed for cups. The short run cost may be less, but the long term consequence may well be fatal to the firm's reputation. Time is still an important factor in pottery manufacture.

(iii) Choice of Fuel

Much vocal effort has been spent on this subject which is rather like discussing blondes and brunettes! I think each manufacturer has to decide for himself on the merits of his problem.

Well-designed electric kilns have so far provided the best efficiencies for net weight of ware fired. On the other hand towns gas kilns have the best cash potential. Research into cutting down the dead weight of placing equipment and increasing the ware content would improve the efficiency of many gas kilns.

Electric kilns seem to be the perfect answer for decorating. For high-grade glost also, electric firing has many advantages—no muffles, no sulphur, very little chimney loss, and very little trouble. For high-grade biscuit firing, electricity has many advantages, but most medium-grade manufacturers seem to favour towns gas on economic grounds.

On possibilities, as distinct from achievements, I think it is generally agreed that if an electric kiln has a theoretically possible efficiency of, let us say, 100, then a gas kiln of similar design would have an efficiency of about 70 per cent. the 30 per cent. difference being due to chimney loss and heat losses, due to combustion chambers, etc.

There is no doubt that towns gas will continue as a very popular fuel so long as its price per therm remains at less than half that of electricity.

In special cases outside this district, producer gas and fuel oil still have distinct possibilities and, of

course, for small loads and fluctuating outputs, the round oven is still an excellent piece of equipment.

Management and Organisation

In a modern factory it is essential that management and organisation should be a match for the building, equipment and technical knowledge. With present-day building costs and a chronic shortage of skilled labour, it is obviously desirable that the best use should be made both of people and equipment.

It is essential, therefore, that the overall managerial problem should receive the same degree of care as the remainder of the factory.

The problem is relatively simple in a small factory where one or two competents can run the place efficiently with the minimum of talk and paper work. In a large factory the problem is far from simple and with a varied product it can be extremely complicated.

Although the very name "planning" causes many of us to fear the worst, it is a necessary feature in tableware production. I refer, of course, to good planning, which should be as simple as possible and not the other sort.

An average factory employing 500 persons might have an organisation split into, say, engineering, design, technical and production, offices, statistics, personnel management and sales. A competent manager would be in charge of each department having foremen or chargehands taking care of teams of people which should range in size from, say, twelve to twenty depending on the job.

Such a team of managers under a general manager, would work out monthly production plans with the sales people and produce the goods with the minimum of loss at the right cost to the time schedule agreed.

To accomplish this, a central planning office is desirable, allied to some simple system of cost accounting and continuous stock control.

On the human side, most firms now appreciate the necessity for specialised personnel management, to deal with the increasing number of problems involved. I think this is an excellent service if it is a genuine and kindly organisation knitted into the old fabric. If it is tagged on as a synthetic stunt it is a poor substitution for the old bullet headed kindliness, which has existed in this district for so long. The best kind of personnel management still emanates from the top of any concern and should infect the mouldrunner. It includes fair dealing, mixed with the milk of human kindness and respect for the other man's point of view. North Staffs potters, more than most, are quick witted decent people, and no amount of "Music While You Work" or cellophaned sandwiches will serve as a substitute. A reasonable degree of happiness and a feeling of importance are essential ingredients in the production of good pottery.

Time and Motion Study

Styled work study is a proved aid to management. Its harsh application in the 1930's created many justifiable prejudices, but these have now been largely overcome by common sense application.

The principles are now well known and consist of meticulous study of movements and method which result in more effective use of skilled labour and increased output per person. Time study also has the great merit of removing the guess work and bargaining from rate fixing.

In my opinion, it is advisable to do some motion study at any rate to get individual layout right and then follow this by time study. Time study with motion study may result in perpetration of wrong methods and bad layout. Increases in output due to work study vary

very considerably, but 25 per cent. is quite a usual figure. This would be on a well-managed piecework job. In easy going day-wage sections improvements up to 80 per cent. are quite common.

Eliminating Movements

In all work study, these improvements are effected by eliminating movements such as fetching and carrying, so as to be able to concentrate on the main essentials. As with most good things, a word of warning is necessary; the subject requires a patient and understanding approach if the best is to be got out of it. Many people are naturally suspicious of something which was bad in 1930, but is recommended in 1950.

Most of the real experts in time study are highly trained, ex works managers, who understand factory life from A to Z. These are the people to work with. I have met one or two of the other sort who give one the impression that industrial life started in a Royal Ordnance factory about 1943! They have the erroneous impression that factory managers and operatives are heathens and that the Almighty sent them as missionaries! Their bible is their platitudinous but well-printed brochure!

Provided safeguards in connection with quality are ensured, I am of the opinion that time study is an essential aid to the achievement of maximum efficiency in any factory. It helps the worker and the firm and the nation.

Importance of Design

In tableware production, design is all important, both from the user's point of view and the producers. This district has enjoyed the benefit of some excellent designers from the 18th Century to the present time. Their products are in museums, collections and homes all over the world, and are a great asset to this country's exports at the present time.

North Staffs best products are recognised standards for the rest of the potting world. Of the mediocre and shocking stuff produced, I think it is fair to say that it is on the decrease as more and more firms recognise the necessity to employ trained designers.

In the competitive times that lie ahead, much will depend on the skill of our designers if we are to maintain our lead over the many countries now producing their own tableware.

Good design is more important than ever in these days of bulk production. In the old days of very small quantities, a bad shape or pattern could be discreetly killed without much loss of cash or face. With a mass produced article, a mistake is liable to be a big one and a lot of people will see it.

My specification for a designer would include a Potteries background, with an early enthusiasm for pots—a Royal College of Arts diploma to prove his skill, followed by a few years in a factory to practise it. He should be encouraged to keep his head in the clouds, but made to keep his feet on the factory floor. It is unwise and unfair to saddle such a man with managerial duties unless, of course, in a very small factory.

Technical Progress

An industry which still employs the principles practised in biblical times, and which has not changed many fundamental processes since Josiah Wedgwood's time, is not conducive to radical alterations. Much progress has been made in all sections of manufacture, but the principles remain very similar.

Since the pioneering days of Dr. Mellor and his enthusiastic band of students in 1902, a great deal of real progress has been made in the technical side—in almost every section, from the slip house to the

packing house. The resulting pot may look somewhat similar to its predecessor, but it is a better pot. It is now possible, with some degree of certainty, to understand the behaviour of ceramic materials in the potting and firing processes and to control them. Knowledge has replaced guesswork and the results constitute a big step forward. Much yet remains to be done, and is being done, by Dr. Webb in this building, and by Dr. Green at the new B.C.R.A. research laboratories.

On the mechanical side, the Americans have led the way and we are now rapidly catching up.

In the newer tile, insulator and sanitary industries, I think this country leads the world, both from a ceramic and production point of view.

(i) Completely Vitreous Body

Apart from really low-priced utility ware, and for thrown and turned ornamental ware, I think the days of porous earthenware for tableware are numbered. The advantages to the user of completely vitreous ware are so obvious that the customer will ultimately demand such a body.

The additional placing and firing difficulties will cause a headache, and the cost will be higher than for earthenware, but if the Americans can make it and we can make bone china, which is much more difficult, there is no good reason for delaying its production.

Assuming the safe minimum temperature for glost firing such a body to be our present glost temperature of, say, 1,050° C., the biscuit would have to be fired at approaching china biscuit temperature if bending in glost is to be avoided. This, of course, is how the Americans arrived at their present procedure.

(ii) Bone China

Bone china is the envy and despair of the Continental and American potters. They have all the necessary data, but lack our 100 years' experience, and craftsmen. We thus have a virtual monopoly of bone china which happens to be the toughest body in the tableware world; a fact well known to ceramic chemists, which should be more widely advertised. Research is needed to improve plasticity and to obtain more latitude in biscuit firing. Other problems concern bone specification and resistance to thermal shock. If some of these production hazards can be reduced with consequent reductions in cost, bone china is a body with a very definite future.

(iii) The Future

I think the future will see a movement to get rid of water from much of the ceramic industry, and from flatware in tableware. Water is a very valuable medium for mixing purposes, but its subsequent removal in terms of filter presses, drying stores, and firing schedules is costly and troublesome. Dry mixing and grinding is now an accomplished fact in many industries, including some of the U.S.A. tile factories, and this, followed by die-pressing, seems to be a profitable line of thought. It is the method employed by the plastic people.

Having removed the water there is not the same need for plastic materials with their shrinkages and cracking properties. A body so compounded of dry mixed non-plastic materials has great firing possibilities and, for those who favour non-traditional decorations, there are distinct possibilities in mosaic and powder effect decorations.

Such a body would be aerographed in glaze and then be once fired since it would have no products of combustion worth speaking of, and would have a very low contraction.

Technical Points

Among the technical points facing the industry are:—

(a) Decrease of clay content and increase of mill materials.
(b) Once-fired ware.
(c) Use of super refractories.
(d) More vitrified ware.
(e) Substitution of alumina for flint in bone china placing.
(f) Use of steatite and lime as anti-craze.
(g) Use of nepheline syenite as flux.
(h) Perfection of overglaze colour to withstand acids and alkalis.
(i) Development of low solubility glazes.
(j) Development of matt glazes.
(k) Development of coloured bodies.
(l) Improvements of lithos, overglaze and underglaze.

Summary

Summarising the points are briefly:—

(i) Mass production and craft production are complementary problems and should live happily side by side—preferably in separate factories.
(ii) This district has built up its world wide reputation as a craft industry. Too much mechanisation of the finer products might lose us this reputation and the craftsmen who created it.
(iii) Completely vitreous bodies for tableware will be demanded by an enlightened - buying public before many years have passed. Are we ready for its production?
(iv) Good factory layout is vital in mass-production and important for any type of ceramic manufacture. Simplicity, with cleanliness and good lighting, are most desirable fundamentals.
(v) New equipment was badly needed in the tableware industry. It is important that such equipment should do its job better than the old equipment, particularly in regard to quality. Equipment which reduces production costs at the expense of quality is a very doubtful economic proposition in the long run.
(vi) With the arrival of the buyer's market and our increased productive power, it is more important than ever before to produce good designs. In my opinion such designs should be of the first-class traditional type, perfectly executed.
(vii) North Staffordshire has the reputation in America and on the Continent for producing the best ceramic technicians in the world—thanks to 50 years'

work of the North Staffs Technical College and a local ceramic background of 180 years' standing. If this knowledge can be used to better advantage in up-to-date factories using the incomparable skill of our craftsmen, this district, which has always led the world in good potting, will continue to do so for many years to come.

MODEL SAFETY RULES
Part I
Supplement No. I

THIS supplement issued by The Association of British Chemical Manufacturers, and relating to the chemical industry contains the changes made necessary by the Factories Act, 1948, together with a few minor changes and additions as the result of experience in use.

The amendments are printed on separate gummed slips to allow of insertion in the blank pages provided for that purpose in the existing rules. Copies of the supplement are being sent gratis to all known purchasers of the original edition of Part I. The amendments will be incorporated in future editions.

Copies of the Third edition of Part I, including a copy of this first supplement, are still available from the Association office at 166 Piccadilly, London, W.1, at the nominal price of 7s. 6d. post free, cash with order.

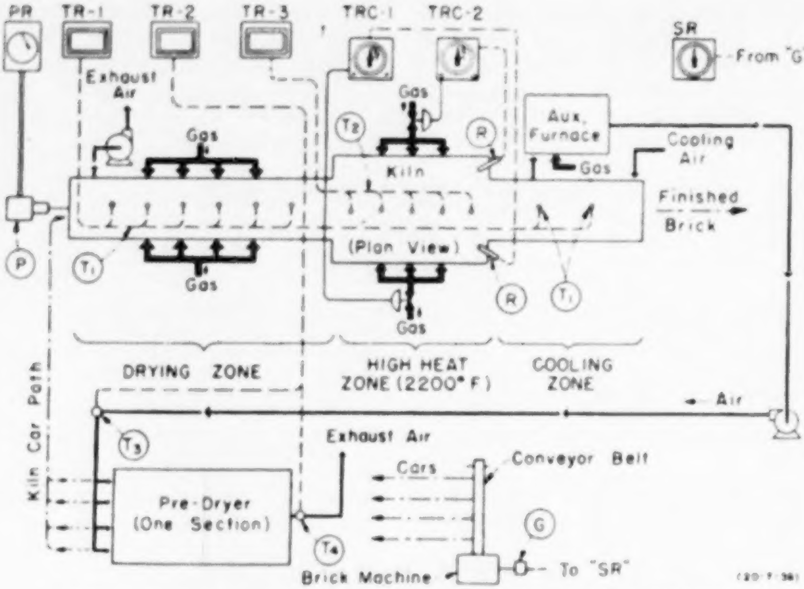
A NEW APPROACH

THE possibility of encouraging local enthusiasm in even refractories and brick production was successfully achieved in Airdrie over October when the "Discovering Airdrie" exhibition was staged in the town. Encouraged by the Bureau of Current Affairs, the idea here was that the town should search back over its history and present a picture of its growth over perhaps 100 years.

The importance of the ceramic industries in the area, deriving from quarrying, brickmaking, refractory production and the iron and steel industries, was demonstrated in the section on local industries. This showed how the present industry of Airdrie sprang from the presence in the area of deposits of clay, coal, ironstone and stone. The original industries, mining, quarrying, brickmaking, fed into the iron founding industry which in turn developed into the steel industry of today. The steel and steel products industry now dominates the area but many smaller units of the older industries remain and prosper.

This exhibition, visited over the period by sociologists from many centres, marks an interesting move towards creating local pride in the accepted and sometimes despised industrial processes. Other areas with a strong ceramic or refractories background might well consider the scope of a similar display.

One of the new floral patterns by Colcloughs of Booths and Colcloughs, Hanley, Stoke-on-Trent, designed especially for the North American market, where a heavier type of colouring is popular. A print and enamel on-glaze, these pleasing designs in the modern technique are a combination of bold outline prints and deep rich enamelling



Schematic diagram of instrumentation for one kiln and one predryer section (duplicated on two other kilns and predryer sections)

Legend: TR-1—Drying and cooling zone multi-point temperature recorder; TR-2—Predryer inlet and outlet temperature recorder (for all sections); TR-3—High-heat zone multi-point temperature recorder; TRC—Recording pneumatic temperature controller for heat zone; SR—Brick machine production recorder; PR—Kiln car pusher hydraulic pressure recorder; T_1—Base metal thermocouples in kiln crown (drying and cooling); T_2—Noble metal thermocouples in kiln crown; T_3—Dry bulb thermocouple for inlet air to predryer; T_4—Wet and dry bulb thermocouple assembly for exit air from predryer; P—Hydraulic car pusher mechanism; R—Radiamatic detecting element; G—Tachometer generator for speed measurement; — — — — T/c extension wire; — · — · Path of kiln cars.

Instrumentation on a Continuous Brick Plant

THE following description relates to the plant of the American Burns Brick Co. started some ten years ago to develop a continuous process from mining of clay to loading of finished bricks on to trucks or railway wagons. The major step was replacing the old batch-type down-draught or bee-hive kilns by continuous tunnel kilns, but plans called for new brick machines, dryers and conveyors.

New Process in Brief

Raw clay from the mines is carried in buckets by overhead cable and dumped into storage bins. It is fed to hoppers over each of two brick machines by a conveyor belt system, so arranged that photoelectric cells on the hoppers can cut off the feed when the clay reaches a predetermined level. The brick machine mixes proper amounts of water with clay and extrudes the mixture through a metal die, thereby shaping two dimensions of the brick. Wire cutters then slice the shaped extrusion into green brick which are carried on conveyor belts to kiln cars on tracks leading to pre-dryers.

After partial removal of excess moisture by heated air in the pre-dryers, the bricks are wheeled on the same cars into continuous tunnel kilns where they are fired to give them permanent shape, strength, and colour.

Industrial Gas, xxix, 3, 5, 7.

As shown on the diagram, the kiln, some 240 ft. in length, is divided into a drying zone where the temperature gradient rises as ware passes through it; a firing zone where temperature is controlled automatically at about 2,200° F. depending upon the type of clay being processed; and a cooling zone where the temperature gradient falls as the ware progresses toward the discharge end.

In the original down-draught kiln it took five days to stack 100,000 bricks from the dryer cars. After the kiln was sealed it took a week to bring the temperature up to 2,000° F., and another week to cool down. The new process produces a car of some 500 bricks as a finished product on definite time schedule, twenty-four hours a day. A car passes completely through the kiln in about thirty-five hours so that the three kilns produce some 50,000 bricks a day.

Close Control

Control of temperature in the bee-hive type oven was obtained roughly from periodic pyrometer readings and manual adjustment of heat input, as compared to automatic control of the continuous kilns to within a few degrees by the electronic instruments. When it is considered that a temperature difference of 10° F. in the firing zone can markedly change the colour of brick, standardisation of colour and other qualities in the former method was obviously impossible. Even with the first continuous kiln installed some 10 years ago, hand control (from thermocouples located at various points in the kiln crown and a Brown indicating millivoltmeter with selector switch) permitted variations of 30° or 40° F.

In the new process, preheated air drawn from the cooling zone of the kilns is raised to about 450° F. by an auxiliary gas-fired furnace and blown into the exit end of the predryer (see diagram). The latter is divided into three sections, one for each kiln, with four car tracks in each section. Temperature of the entering air to each section is measured by an iron-constantan thermocouple (T_1) installed in the common air duct from the auxiliary furnace. This measurement is recorded on a strip chart ElectroniK potentiometer which logs one such record for each of the three sections of the predryer. From these records, gas supply to the auxiliary furnace of each kiln is manually adjusted to provide the desired 450° F. air.

Relative Humidity of Exhaust Air

At the loading end of each predryer section, a wet and dry bulb thermocouple assembly (T_2) is mounted in the exhaust air duct. This assembly comprises two conventional thermocouples, one dry and one continually wetted by a wick which is immersed in a water tank equipped with an automatic float-operated level control.

These thermocouples are connected to the same strip chart recorder mentioned above and their two measurements serve to indicate the relative humidity of the exhaust air.

If the exhaust air is too dry the green brick case hardens, preventing further removal of moisture; if the air is too wet the brick absorbs the excess moisture and swells up until it collapses on the kiln car. The wet and dry bulb temperatures serve as a criterion for manual control of inlet air dampers on the auxiliary furnace, which thus regulate the moisture content. Automatic control is contemplated for this purpose, as well as for inlet air temperature control, by means of ElectroniK pneumatic controllers positioning diaphragm motor lever operators and valves for the air dampers and gas supply.

Kiln Temperature Controls

As shown in the diagram, the high heat zone of each kiln is automatically controlled by two circular chart ElectroniK potentiometers. TRC-1 and TRC-2, which incorporate pneumatic control units with proportional band adjusted to about 3 per cent. Measurement of actual brick temperature (not kiln air temperature) is made on both sides of the zone by two radiational type elements (R) which convert heat energy radiated from the ware into a minute emf related to the ware temperature.

Each element is sighted at an oblique angle on the side of the ware toward the exit end of the firing zone. The exact mounting angle was determined experimentally to prevent extraneous fluctuations in measurements, and

hence control, which would result from sighting of the elements between cars.

Independent control of both sides of the kiln is considered quite necessary because of such factors as wind effect, minor differences in burner firing, and varying radiation losses which might otherwise cause a temperature difference to occur across the wider area of the firing zone. Each radiation pyrometer therefore operates a separate fuel control valve on its respective side of the furnace. The fuel used is natural gas which is fed to multiple, venturi type burners installed strategically in the firing zone.

Additional Check Points

As also shown in the diagram, a number of additional temperature check points are obtained in the three kiln zones by means of thermocouples installed in the crown and connected to multipoint strip chart recorders. Three 16-point ElectroniK recorders are used for three kilns—one being calibrated 1,500° to 3,000° F. for five noble metal thermocouples (T_2) installed in the high heat zone; while the other two are calibrated 0° to 2,000° F. for the six couples (T_1) installed in the drying zones and the two similar couples installed in the cooling zones.

The noble metal thermocouples are provided with an 18 in. double protecting tube of Sillimanite to withstand the high temperatures and are inserted through a firebrick block in the kiln crown; the thermocouples are furnished with 18 in. metal protecting tubes. Records obtained from these thermocouples along the length of each kiln are an invaluable check on the all-important temperature gradient which is obtained by the automatic controls as well as the burner adjustments, and which is prerequisite to properly fired bricks. A glance at the records grouped on one chart serves to indicate if the gradually rising and lowering trend of temperature has been maintained.

Other Instruments

In addition to the temperature recorders and controllers discussed above, several other instruments were selected, primarily as operations recorders—that is, as a permanent log of equipment functioning. On each of the brick machines, for example, a small tachometer generator (G) is attached to the electric drive motor and electrically connected to a circular chart ElectroniK recorder (SR) calibrated to read directly in bricks per hour.

Similarly, a conventional pressure recorder (PR, range 0 to 1,000 p.s.i.) is piped to the hydraulic pusher mechanism which periodically moves the cars through the kilns. This instrument shows the time each car enters the kiln, and also serves to indicate any faulty operation of the mechanism or blocking of cars in the kiln.

These latter recorders are installed together with the temperature instruments on a centralised panel board adjacent to the main office and visible through a plate glass partition. A brief survey of this board provides the plant management with an accurate and up-to-the-minute report on all phases of the manufacturing process. The chart records also serve a longer term function as a permanent log of the processing given any particular run of bricks.

Increase in Production

After checks on operating efficiency over a period of several years, it has been established that the addition of automatic temperature control alone, resulted in at least a 10 per cent. increase in brick production, as compared with the same processing methods on manual control. When combined with the numerous other innovations throughout the entire manufacturing process, the complete instrumentation has proved eminently satisfactory from the added standpoint of consistent high quality of ware and over-all lowering of operating costs.

Trouble Detector

In the three-and a half mile conveyor system, which is nearing completion, to transport clay from mine to plant, there is a remote but ever present possibility of faulty operation developing—as caused, for example, by cable going off its track or conveyor buckets jamming. Because of the tramway length and the fact that it is supported some distance above the ground, constant human supervision of its operation is not feasible; an automatic instrument system is, therefore, being contemplated and is briefly described below as a novel application,

even though it is not yet installed.

The instrument system under consideration utilises a standard circular chart ElectroniK resistance thermometer, with minor design changes to measure the total resistance of a signal cable running the length of the tramway and a return ground cable.

Under normal conditions the instrument reads at some value, say 20 on a 0 to 25 evenly divided chart, to correspond to the full length of the tramway in thousands of feet. Along the conveyor some ten to fifteen trouble detector stations are to be strategically located. In the event of trouble at or near such a station, a suitable mechanism is to close a connection between the signal and ground cable, thereby decreasing the measured cable resistance by an amount dependent upon the distance of the station from the plant.

Decrease of the cable resistance will cause the instrument pen and pointer to move downscale, indicating location of trouble in terms of distance from the plant. An auxiliary mercury switch mechanism in the instrument is to be set to close contact when the pen moves from its normal position. This switch will sound an alarm in the plant office and cut off power to the conveyor-drive motor. An external resistor wired in the resistance circuit is to be used to compensate for changes of cable resistance due to ambient temperature variations.

EASING THE SWITCHMAN'S TASK

AN entirely new lever box has been designed that, for the first time in railway history, considers the man who has to operate it, as well as the task it has to perform.

Aptly named "David," and produced by Thos. Summerson and Sons Ltd., the railway siding engineers, this new lever box enables a heavy switch to be thrown by arm power only. No longer is it necessary for a switchman to risk disablement or serious strain. David, in fact, makes switch throwing almost as easy as closing a gate. Recent tests showed that David is nearly three times easier to operate than the type of spring acting lever boxes generally fitted by railway undertakings.

The new "David" lever box

David has been designed to overcome the resistance of a toggle spring strong enough to close heavy switches. The force necessary to operate such a spring is spectacularly reduced by means of a toothed rack, geared to its lower end, by which device an exceptionally powerful leverage is obtained. This leverage operates only during that part of the movement in which resistance of the spring is being met; that is, until the dead centre of the movement of the toggle is reached. At that point an automatic change of fulcrum takes place which reduces the leverage in the second half of the movement.

BIRLEC LIMITED

BIRLEC LIMITED, the well-known heat treatment and melting furnace manufacturers, announce the appointment of Mr. S. G. King, A.M.I.E.E., as their London Manager with offices at 35 Park Street, London, W.1.

Mr. King has had 20 years' experience of electric furnace work, particularly in connection with the development and sale of arc and high frequency melting equipment. He has recently returned from a 4 years' stay in South Africa and he has had wide experience in many European countries.

AEROFOIL FANS

WE have received a most interesting brochure from Woods of Colchester Ltd., an associate company of the General Electric Co. Ltd., dealing with Aerofoil fans.

This is claimed to be a new development in axial flow fans and a cross-section diagram of the fan is reproduced. All sizes of the adjustable impeller are geometrically similar and have identical characteristics so as to cover the entire range of volumes and pressures in smooth steps. This has been arrived at by maintaining the ratio of the hub diameter to the impeller diameter as constant throughout the range.

A series of electric motors has been developed with frame diameters matching the impeller hub sizes and the motors are produced as integral parts of the fan.

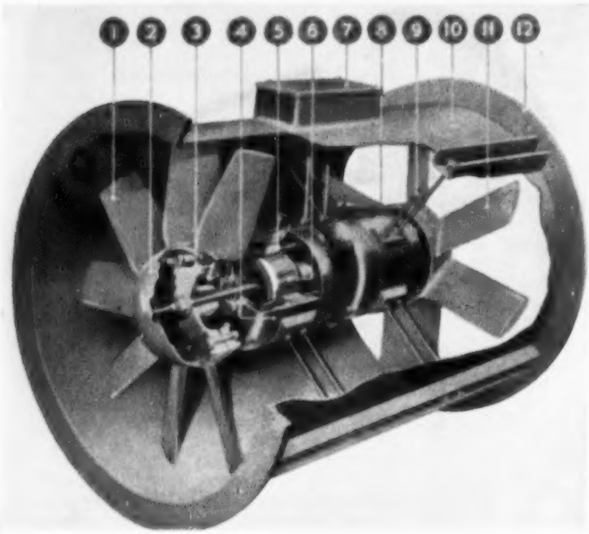
There are nine sizes of single stage fans from 6 in. to 48 in. The adjustable impeller is fitted to sizes from 15 in. upwards whilst for the three smallest units 6 in., 8½ in. and 12 in. solid cast impellers are used.

An interesting point claimed about the Aerofoil is that the two-stage fans with contra-rotating impellers develop 2½ times the pressure of a single-stage fan without any proportionate noise increase.

Total efficiencies of the fans are in the neighbourhood of 70 per cent. over a wide range of volumes and pressures, with an efficiency at about 78 per cent. total and 67 per cent. static.

The brochure in question deals in detail with sound level ratings and performance characteristics. The multi rating selection tables are most comprehensive and show at a glance the most suitable fan available for any required duty within the capacity of the range.

Dimensional details and prices are included in the brochure. Altogether a most useful shelf acquisition to users of industrial fans.



1 Second-stage impeller.
2 Domed hub fairing.
3 Adjustable pitch impeller—this design is used on all Single Stage Fans above 12 in. diameter.
4 Totally enclosed motors built specifically for these fans.
5 A.C. stator laminations die-cast into aluminium carcases.
6 Die-cast squirrel cage rotor.
7 Weather-proof external terminal box.
8 Stauffer lubricators, easily accessible through inspection door.
9 Stainless steel fan supports.
10 Heavy gauge mild steel casings with channel iron reinforcements.
11 First stage impeller (fixed blade type).
12 Wide flanges drilled for fixing.

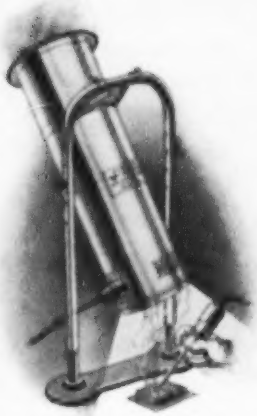
BRITISH THERMOSTAT CO. LTD.

FOR one month, namely the 13th November to the 13th December, window space has been taken for an exhibit at the Engineering Centre, 351 Sauchiehall Street, Glasgow, C.2, which is in addition to a permanent exhibit at the Centre on the first floor, where there is the display cabinet featuring the company's range of automatic control equipment.

C.Y. ALLOY

IN the October issue of CERAMICS reference was made to the above material, and we have now been informed by Follsain-Wycliffe Foundries Ltd., Lutterworth, nr. Rugby, that they have recently come to an agreement with Wootton Bros. Ltd., Coalville Iron Works, Coalville, that the latter will be supplied in bulk with spares for their machines in C.Y. Alloy. The necessary patterns will be supplied by Wootton Bros. This is a similar arrangement which has been maintained with Bradley and Craven Ltd. for some little time.

FUME EXTRACTOR



The Pyrobit fume extractor

IN many operations such as soldering, glazing, welding, heat treating and laboratory work, fumes are evolved which are obnoxious and often injurious to health.

In addition, it is often necessary to carry out these operations on an open bench.

The Pyrobit Fume Extractor manufactured by the Acru Electric Tool Manufacturing Co. Ltd., 123 Hyde Road, Ardwick, Manchester 12, which is illustrated, uses the heat emission of an electric element which illuminates the workbench. It thus provides a combined ventilation and work illuminating device, creating a chimney effect which disperses the fumes in a diluted form above the level of the worker's head.

BLACK-OUT RISKS IN POTTERIES

AN all-party group of members met a deputation of the National Municipal Electricity Consumers' Association and listened to a letter written by Mr. Cuthbert Bailey, of Doulton and Co. Ltd., Burslem, to the British Pottery Manufacturers' Federation.

The letter stated:

May I stress the hope that appropriate pressure will be brought to bear on the authorities to convey at least 15 minutes warning of an approaching blackout?

We can deal in a normal way with a cut in voltage, but an abrupt and unannounced black-out immediately raises matters of extreme anxiety to the safety of personnel and to tunnel oven equipment.

In the last 3 years we have had two explosions on this factory, solely associated with this experience and in each case the explosion has shattered the blower regulating a constant proportion of gas and air and on each occasion an internal and commercially disastrous explosion might have occurred inside one or more tunnel ovens.

Such a thing as this is monstrously wicked. The Home Office have issued many books on safety in Gas operated equipment, such as tunnel kilns and quoted many accidents. They have recommended control systems whereby gas supply, fans and electrical supply, are interconnected.

Unfortunately, Members of the Government have never had any experience of the responsibility to life which lies in the hands of industrial management—and neither have their "Whitehall Warriors!" How can one expect barristers, schoolteachers, university Dons and economists to appreciate the human problems of life and safety existing daily on the factory floors of Britain?

SCOTTISH SILICA SAND PROTECTION

THE silica sand mining industry in Scotland is now facing an increasingly difficult situation as a result of the lifting of the ban on unrestricted imports of Continental sand.

The transport rates from the West Highland areas where the silica is mined have been uniformly higher than those from the Continent. This enables the Dutch and Belgian firms to deliver excellent silica sand at the main Scottish and English glass making centres, at a price competitive to the native product.

Argument advanced for the retention of the home industry is that it was a most vital factor over the war years in preserving the production of high-grade optical glass. The situation now developing is virtually that of protecting a vital home industry or of allowing it to lapse until the next crisis makes it essential and economic to open the mines again.

The latter policy is probably that dictated by the economics of the situation and may carry weight at a time when manufacturers are seeking every economy in production costs. At the same time a strong case could be made out for some form of protection—even if only in the form of cheaper sea transport from Scotland—to enable this enterprise and industry to survive.

Main centre is the famous Lochaline deposits in Morven, opened on a large scale during the war years and worked extensively since.

RATION SCHEME FOR BRICKWORKS

SCOTTISH brickworkers are working to maximum capacity to meet the current demand for bricks, which far exceeds the supply. The demand comes not only from house builders but from a very wide range of industrial building projects, many of which are being delayed because of the scarcity of bricks.

So acute has the demand become that brickworks in some parts of Scotland have initiated rationing schemes to limit the amount of individual buying. Previously drivers arrived at the works in the very early hours of the morning and slept in the queue until the works opened.

From the constructional angle the delay in delivery means corresponding delays right through the programme as well as a limitation in the number of men who can be employed and the speed with which the work can be finished.

Many of the Scottish brickworks went over to National Coal Board control at the take-over of the coal industry. Many others remain in private ownership. All are working all-out to meet the current demand which derives essentially from the failure to stock-pile at a time when this could have been done. Lack of official encouragement and the switch to non-traditional types influenced the position and discouraged stockpiling. Many brickworks did stock to the maximum available scope and have since cleaned out their stocks. The position promises to remain difficult for some time ahead.

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